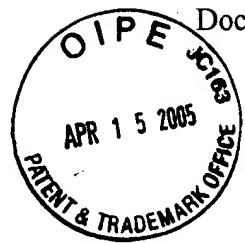


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Docket No. SP-1093.3

Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Examiner: Deborah K. Ware  
Group Art Unit: 1651  
Applicants: Wong et al.  
Serial No.: 09/912,471  
Filed: July 24, 2001  
For: METHOD FOR PRODUCING ULTRAPURE PROTEIN MATERIAL

"Express Mail" Label No. EV 042960278 US  
Date of Deposit April 15, 2005

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By Tonya Walker  
Typed Name: Tonya Walker

Hon. Commissioner of Patents and Trademarks  
Alexandria, VA 22313-1450

Dear Sir:

**APPEAL BRIEF**

On November 16, 2004, Appellant appealed from the final rejection of claims 81-93 and 96-124.

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**TABLE OF CONTENTS**

	Page
Real Party in Interest	3
Related Appeals and Interferences	4
Status of Claims	5
Status of Amendments	6
Summery of the Invention	7
Issues	8
Grouping of Claims	9
Argument	10
Conclusion	16
Appealed Claims (Appendix A)	17
Natuphos® Curricular	Exhibit A
Theodore M. Wong Declaration	Exhibit B
In re Oelrich, 666 F2d 578 (CCPA 1981)	Exhibit C
Mehl/Biophile Int. v. Milgraum, 192 F.3d 1362 (Fed. Cir. 1999)	Exhibit D
Trintec Ind. Inc. v. Top USA, 295 F.3d 1292 (Fed. Cir. 2002)	Exhibit E
Rosco Inc. v. Mirror Lite Co., 304 F.3d 1373 (Fed. Cir. 2002)	Exhibit F
In re Robertson, 169 F.3d 743 (Fed. Cir. 1999)	Exhibit G
Continental Can Co. v Monsanto 948 F.2d 1264 (Fed. Cir. 1991)	Exhibit H
Appl. Microbiol. 16: pp. 1348-1351, 1968	Exhibit I
Enzyme Microb. Technol. pp. 5: 377-382, 1983	Exhibit J
In re Carleton, 599 F.2d 1021 (CCPA 1979)	Exhibit K
In re Fay, 347 F.2d 597 (CCPA 1965)	Exhibit L

**REAL PARTY IN INTEREST**

Solae, LLC, a corporation of the State of Delaware located at P. O. Box 88940 St. Louis, MO 63188, is the real party in interest in the appeal of the present application, having been assigned the application by the inventors.

**RELATED APPEALS AND INTERFERENCES**

There are no related appeals or interferences pending with respect to the present application.

**STATUS OF CLAIMS**

Claims 1-80 were originally filed in the present application. On October 2, 2002, a Restriction was made between Group I (claims 1 and 3-36) and Group II (claims 37-80). On November 1, 2002, Applicant elected the claims of Group I and withdrew claims 37-80. On October 31, 2003, Applicant cancelled claims 1-80 and added claims 81-132. In an Office Action dated January 28, 2004, a Restriction was made between Group I (claims 81-124) and Group II (claims 125-132). On March 30, 2004, Applicant elected the claims of Group I and cancelled claims 125-132. Applicant further cancelled claims 94 and 95. A final Office Action was mailed on August 8, 2004. A response, but with no amendment was made on November 16, 2004. Claims 81-93 and 96-124 remain pending in the present application and are the subject of this appeal. A copy of the pending appealed claims is attached in Appendix A. No claims are allowed.

**STATUS OF AMENDMENTS**

A response after final rejection was filed on November 16, 2004. No amendment to the claims was submitted in that response.

**SUMMARY OF CLAIMED SUBJECT MATTER**

This invention relates to a method for reducing the concentrations of ribonucleic acids and minerals bound to ribonucleic acids from a vegetable protein material. A vegetable protein material is provided and is slurried in an aqueous solution. The slurry is treated with an enzyme preparation containing an acid phosphatase at a pH and a temperature and for a time effective to substantially reduce the ribonucleic acid concentrations in the vegetable protein material. The treated slurry is then washed to provide a vegetable protein material having a reduced concentration of ribonucleic acids.

In a preferred embodiment of the invention, the mineral content of the vegetable protein material is reduced by treatment of the vegetable protein material slurry with the enzyme preparation containing an acid phosphatase.

In another preferred embodiment of the invention, the vegetable protein material is a soy protein, the pH at which the slurry is treated with the enzyme preparation is from about 3 to about 6, the temperature at which the slurry is treated with the enzyme preparation is from about 20°C to about 70°C, and the time period over which the slurry is treated with the enzyme preparation is from about 30 minutes to about 4 hours. The treated slurry is washed after being treated with the enzyme preparation.

In yet another preferred embodiment, the slurry is heat treated after being enzymatically treated and washed, and the heat treated slurry is dried.

In another aspect, the invention is a method for reducing the concentrations of phytic acid, phytates, ribonucleic acids, and minerals bound to phytic acid, phytates, and ribonucleic acids from a vegetable protein material. A vegetable protein material is provided and is slurried in an aqueous solution. The slurry is treated with an enzyme preparation containing an acid phosphatase and a phytase at a pH and a temperature and for a time effective to substantially reduce the phytic acid, phytate, and ribonucleic acid concentrations in the vegetable protein material.

**GROUNDS OF REJECTION**

1. Whether under 35 U.S.C. §102(b) the subject matter of claims 81-93 and 96-124 are anticipated by EP 0 380 343.
2. Whether under 35 U.S.C. §103(a) the subject matter of claims 81-93 and 96-124 are obvious to one of ordinary skill in the art over EP 0 380 343.

**ARGUMENT****EP 0 380 343 A2**

EP 0 380 343 A2 (the '343 patent) teaches a method for production of phytate-free or low-phytate soy protein isolates or soy protein concentrates. The '343 patent is directed to a method of degrading phytates with one or more phytate-degrading enzymes, where acid phosphatases are disclosed as one type of phytate-degrading enzyme. The '343 patent does not disclose or mention ribonucleic acids at all.

**First Ground of Rejection**

Claims 81-93 and 96-124 are rejected under 35 U.S.C. §102(b) as being anticipated by EP 0 380 343.

Claim 81 and its dependent claims 82-93 and 96-124 provide methods for producing a soy protein material in which an aqueous slurry of a soy protein material is treated with an enzyme preparation containing an acid phosphatase enzyme to degrade ribonucleic acids in the soy protein material, and then the soy protein material is washed to remove degraded ribonucleic acids.

Claim 81 and its dependent claims are not explicitly anticipated by the '343 patent since the '343 patent does not disclose ribonucleic acids at all, and clearly does not teach any means of degrading ribonucleic acids or washing a soy protein material to remove degraded ribonucleic acids. Therefore, the only possible basis for anticipation is that the claims are inherently anticipated by the '343 patent.

Claim 81 and its dependent claims, however, are not inherently anticipated by the '343 patent since the process disclosed by the '343 patent does not necessarily result in the degradation of ribonucleic acids in a soy protein material by an enzyme preparation containing an acid phosphatase. Anticipation by inherency applies when a claimed element is "always present" and "naturally flows" from the prior art disclosure. Inherency may not be established by probabilities or possibilites—the mere fact that a certain thing may result from a given set of circumstances is not sufficient. See In re Oelrich, 212 USPQ 323, 326 (CCPA 1981). More particularly, for a claim element to be anticipated inherently by a reference the element must be a necessary consequence of

what was deliberately intended as disclosed in the prior art reference. *Mehl/Biophile International Corp. v. Milgraum*, 52 USPQ2d 1303, 1307 (CAFC 1999). Occasional results are not inherent. *Id.* at 1306. See also *Trintec Industries Inc. v. Top-U.S.A. Corp.*, 63 USPQ2d 1597, 1599 (CAFC 2002); *In Re Robertson*, 49 USPQ2d 1949, 1950-51 (CAFC 1999); *Rosco Inc. v. Mirror Lite Co.*, 64 USPQ2d 1676, 1679-81 (CAFC 2002); and *Continental Can Co. USA v. Monsanto Co.*, 20 USPQ2d 1746, 1748-1750 (CAFC 1991).

The Office Action clearly shows that the basis for the §102(b) rejection is that the EP 0 380 343 reference teaches a process that produces the presently claimed processes wherein ribonucleic acids in a soy protein material are reduced by degrading the ribonucleic acids with an enzyme preparation containing an acid phosphatase enzyme because the reference utilizes a FINASE® enzyme preparation that contains an acid phosphatase to degrade phytates in an aqueous slurry of soy protein material. Applicants note, however, that the reference teaches a process that may utilize an enzyme preparation that contains an acid phosphatase enzyme in a soy protein material, but does not teach that the enzyme preparation must contain an acid phosphatase enzyme—and, therefore, the claims of the present application are not inherently anticipated by the cited reference.

The reference does not limit the enzyme preparations used to reduce phytates in soy protein to FINASE® enzyme preparations. Specifically, on page 6, lines 38-41 the EP 0 380 343 A2 reference states:

- Stated most simply, in its broadest terms, the present invention comprises:
- (a) suspending defatted soy bean particulate in an aqueous medium in the presence of an enzyme preparation comprising one or more phytate-degrading enzymes (emphasis added); and
  - (b) isolating the resulting phytate-free or low phytate soy protein.

The reference explains what phytate-degrading enzymes are, with respect to the invention of the reference (page 6, lines 16-27):

In the various aspects of the present invention, phytic acid is eliminated by means of effective commercially available bulk enzyme compositions. Phytate-degrading enzymes dephosphorylate inositol-hexaphosphate to yield inositol and orthophosphate, several forms of inositolphosphates being the intermediate products. Phytate degrading enzymes include phytase and acid phosphatases.

Phytase and acid phosphatases are produced by various microorganisms such as Aspergillus spp., Rhizopus spp., and yeasts (Appl. Microbiol. **16**: 1348-1357 (1968) Enzyme Microb. Technol. **5**: 377-382 (1983)), and phytase is also produced by various plant seeds, for example wheat, during germination. According to methods known in the art, enzyme preparations can be obtained from the above mentioned organisms. Caransa et al. Netherlands Pat. Appl. 87.02735, found that at the same enzyme dosage phytase from Aspergillus spp. degraded phytic acid in corn more efficiently than phytase from wheat.

Particularly preferred for the purposes of the present invention are the Finase enzymes, formerly termed Econase EP 43 enzymes (emphasis added), manufactured by Alko Ltd., Rajamaki, Finland.

Thus, the reference discloses that use of the FINASE® enzyme preparations is a preferred method of practicing the disclosed invention, but that the process of the reference is not limited to use of FINASE® enzymes and can utilize any phytate-degrading enzyme preparation containing one or more phytate-degrading enzymes, where such enzyme preparations can be produced from *Aspergillus spp.*, *Rhizopus spp.*, yeasts, and various plant seeds such as wheat.

These enzyme preparations do not necessarily contain an acid phosphatase enzyme effective to degrade ribonucleic acids in a vegetable protein material. The reference itself implies that enzyme preparations useful in the process of the reference that contain phytase, but not acid phosphatase, can be derived from various plant seeds, for example wheat, during germination. The absence of acid phosphatase enzymes in these plant seed phytase enzyme preparations can be inferred from the sentence in which it is disclosed that phytase and acid phosphatases are produced by various microorganisms, yet the plant seed enzyme preparations are disclosed as only containing phytases (EP 0 380 343 A2 p. 6, lines 20-22). As such, it is clear that the reference discloses enzyme preparations containing no acid phosphatase enzymes among the enzyme preparations that are effective to practice the method of reducing phytates and phytic acid in accordance with the method of the reference.

Even enzyme preparations derived from microorganisms such as *Aspergillus spp.* do not necessarily contain an acid phosphatase enzyme effective to practice the claimed invention. There are numerous strains of phytase producing *Aspergillus spp.*, including *Aspergillus oryzae*, *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus terrus*, *Aspergillus carneus*, and *Aspergillus fumigatus*, not all of which produce enzyme preparations containing acid phosphatase that are effective to degrade ribonucleic acids in accordance

with the present invention. For example, NAUTUPHOS® is an enzyme preparation that is commercially sold as a phytase (*see Exhibit A attached hereto*) that is derived from *Aspergillus niger*, yet does not degrade ribonucleic acid in a vegetable protein material in accordance with the current claims (*see Theodore M. Wong declaration, Exhibit B attached hereto*). Such phytate-degrading enzyme preparations clearly fall within the description of the process of the reference since they degrade phytates and phytic acid when utilized in accordance with the disclosed process (*see Exhibit B*).

The cited reference, therefore, clearly does not intend to limit the disclosed method of reducing phytates and phytic acids to using only FINASE® enzyme preparations. Page 6, lines 16-27, of the EP 0 380 343 A2 reference certainly indicates that other phytase enzyme preparations were contemplated for use in the disclosed process, particularly since FINASE® is derived from *Aspergillus niger*, yet the reference discloses many other sources of phytase enzymes. Furthermore, claim 3 of the cited reference states that the method of the reference is intended to include enzymes originating from *Aspergillus spp.*, *Rhizopus spp.*, and yeast. Therefore, the deliberate intent of the cited reference, to degrade phytates and phytic acid, can be achieved utilizing other enzyme preparations that do not degrade ribonucleic acids or do not contain an acid phosphatase enzyme (e.g. NATUPHOS® enzyme).

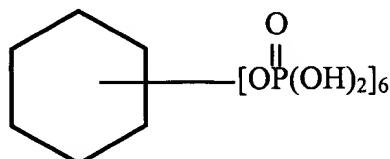
The Examiner may have reached this conclusion as well, since page 6 lines 7-9 of the Office Action of February 7, 2003 states “Further, in view of the teaching of FINASE in the cited EP reference it is apparent that the preparation may indeed include an acid phosphatase”. Under the case law cited above, the fact that the process of the cited EP reference may indeed contain an acid phosphatase is insufficient to establish inherent anticipation. The process of the cited reference must always contain an acid phosphatase in order to establish inherent anticipation.

Furthermore, even if the FINASE enzyme preparation disclosed in the ‘343 patent as a preferred enzyme preparation always degrades ribonucleic acids in the slurry of soy protein material, the ‘343 patent disclosure of the use of the FINASE enzyme preparation in a soy material is insufficient to establish inherent anticipation because the deliberate intent of the ‘343 patent is to degrade phytates with one or more phytate-degrading

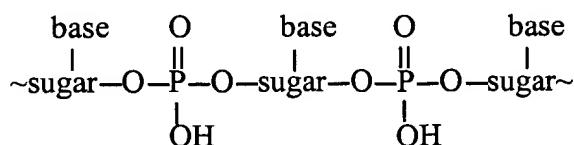
enzymes, which can be accomplished, as discussed above, with other non-FINASE enzymes that do not result in the degradation of ribonucleic acids. It is irrelevant to a determination of anticipation by inherency if a FINASE enzyme preparation always degrades ribonucleic acids in an aqueous slurry of a soy protein material in the process taught in the '343 patent because the deliberate intent of the '343 reference is to degrade phytates in a soy protein material with one or more phytate degrading enzymes that are not limited to FINASE enzyme preparations. As the Mehl/Biophile case requires, inherent anticipation is determined in accordance with the deliberate intent of the cited reference, and clearly the cited reference deliberately intended to include enzyme preparations beyond FINASE enzyme preparations as useful for degrading phytates in a soy protein material. Therefore, degradation of ribonucleic acids is not a necessary consequence of the deliberate intent of the process of the '343 patent, and the disclosure of the '343 patent does not inherently anticipate the present invention.

It is the opinion of the Patent Office that while EP '343 does not disclose ribonucleic acids, or to a use of an enzyme to degrade them that nevertheless RNAs would be degraded simply because RNAs contain phosphorus groups and the EP '343 use phosphatase enzyme. In EP '343 phosphatase enzymes are used to reduce or eliminate phytates in soy proteins. Phytates are phytic acid or the calcium, magnesium and potassium salts of phytic acid, the latter of which are called phytin.

Phytic acid is represented by the below structure and has a molecular weight of 660.



Ribonucleic acid is a polynucleotide chain of ribose, phosphoric acid and organic bases of purines (adenine and guanine) and pyrimidines (cytosine and uracil). A representation of RNA is below.



RNA like DNA is a long unbranched macromolecule consisting of nucleotides joined by 3'- 5' phosphodiester bonds. The number of nucleotides in RNA varies from 75 to thousands. RNA has a hydroxyl group at C-2 of ribose that is not present in DNA. DNA is capable of forming a double stranded molecule. Because of the extra hydroxyl group in RNA, RNA is too bulky to form a double stranded molecule. While RNA is single stranded, parts of it can bend and form loops where the bases can pair up with each other. Further, the positions of the bases are stabilized by hydrogen bonding.

RNA is thus a very large and bulky molecule whereas phytic acid is not. Phytase enzyme is able to easily react with phytic acid to degrade phytic acid. Because of hydrogen bonding and steric hindrance, one would not expect phytase to degrade RNA. One would not look to non-analogous art (EP '343) to solve the problem of degrading RNA as per the instant invention.

RNAs and phytic acid both contain phosphorous groups. However, one skilled in the art would not utilize the teachings of EP '343 of enzymes and phytic acid to arrive at the present invention of enzymes RNAs. Phosphorous groups aside, phytic acid and RNAs are very different chemical entities. Chemistry is largely empirical and therefore there is often great difficulty in predicting how a given compound will behave. *In re Carleton* (CCPA 1979) 599 F2d 1021, 202 USPQ 165. Further, because chemistry is often an empirical science, it is easy to characterize inventions in the field of chemistry as the result of "routine testing". But even "routine testing" must be guided and directed by the mental concept of the inventor. "Routine experimentation" does not negate patentability. 35 USC 103, last sentence; *In re Fay et al.* (CCPA 1965) 347 F2d 597, 146 USPQ 47. Reconsideration and withdrawal of rejection is respectfully requested.

#### Second Ground of Rejection

Claims 81-93 and 96-124 are rejected as being unpatentable under 35 U.S.C. §103(a) over EP 0 380 343.

Claim 81 and its dependent claims 82-93 and 96-124 are rejected as obvious over the '343 patent since allegedly any difference between the claims and the '343 patent is

considered to be so slight as to render the claims *prima facie* obvious over the '343 patent. As noted above, however, the '343 patent provides no disclosure at all relating to degrading ribonucleic acids. One skilled in the art would learn absolutely nothing about how to degrade ribonucleic acids from the '343 patent, and thus one skilled in the art would never look to the '343 patent for any guidance in determining an effective method for degrading ribonucleic acids in a soy protein material. Therefore, no basis whatsoever has been established for a case of *prima facie* obviousness based on the disclosure of the '343 patent.

Appellant states that the instant claims are not obvious under 35 USC §103(a) over EP 0 380 343. Reconsideration and withdrawal of this ground of rejection is respectfully requested.

**CONCLUSION**

In view of the discussion of the reference, coupled with Appellant's response, Appellant states that the Examiner's rejection of claims 81-93 and 96-124 are not anticipated under 35 U.S.C. §102(b), over EP 0 380 343, or, in the alternative, are not obvious under 35 U.S.C. §103(a) over EP 0 380 343 and reversal of the Examiner's decision is respectfully requested.

If any additional fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to our Deposit Account No. 50-0421.

Respectfully submitted,

Solae, LLC

Date: April 15, 2005

James L. Cordek  
JAMES L. CORDEK  
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314.982.2409

## **APPENDIX A – APPEALED CLAIMS**

Claims 1-80 (cancelled)

Claim 81 (previously added) A method for producing a soy protein material comprising,  
forming an aqueous slurry of a soy protein material  
treating the slurry with an enzyme preparation containing an acid  
phosphatase enzyme at a temperature, a pH, and for a time period effective for said  
enzyme preparation to degrade ribonucleic acids in the soy protein material; and  
washing the soy protein material to remove degraded ribonucleic acids.

Claim 82 (previously added) The method of claim 81 wherein said protein material is a  
soy protein concentrate or a soy protein isolate.

Claim 83 (previously added) The method of claim 81 wherein said slurry contains from  
about 2% to about 30% of the protein material by weight.

Claim 84 (previously added) The method of claim 83 wherein said slurry contains from  
about 5% to about 20% of the protein material by weight.

Claim 85 (previously added) The method of claim 83 wherein said slurry contains from  
about 10% to about 18% of the protein material by weight.

Claim 86 (previously added) The method of claim 81 wherein treatment of said slurry  
with said enzyme preparation is effective to degrade a majority of ribonucleic acids in  
said soy protein material.

Claim 87 (previously added) The method of claim 86 wherein washing the treated slurry  
is effective to remove said degraded ribonucleic acids to provide a soy protein material  
from which a majority of ribonucleic acids have been removed.

Claim 88 (previously added) The method of claim 81 wherein treatment of said slurry with said enzyme preparation is effective to degrade at least 60% of ribonucleic acids in said soy protein material.

Claim 89 (previously added) The method of claim 88 wherein washing the treated slurry is effective to remove said degraded ribonucleic acids to provide a soy protein material from which at least 60% of ribonucleic acids have been removed.

Claim 90 (previously added) The method of claim 81 wherein treatment of said slurry with said enzyme preparation is effective to degrade at least 70% of ribonucleic acids in said soy protein material.

Claim 91 (previously added) The method of claim 90 wherein washing the treated slurry is effective to remove said degraded ribonucleic acids to provide a soy protein material from which at least 70% of ribonucleic acids have been removed.

Claim 92 (previously added) The method of claim 81 wherein treatment of said slurry with said enzyme preparation is effective to degrade at least 80% of ribonucleic acids in said soy protein material.

Claim 93 (previously added) The method of claim 92 wherein washing the treated slurry is effective to remove said degraded ribonucleic acids to provide a soy protein material from which at least 80% of ribonucleic acids have been removed.

Claims 94-95 (cancelled)

Claim 96 (previously added) The method of claim 81 wherein treatment of said slurry with said enzyme preparation is effective to degrade phytic acid and phytates in said soy protein material.

Claim 97 (previously added) The method of claim 96 wherein washing said treated slurry is effective to remove said degraded phytic acid and phytates to provide a soy protein material from which phytic acid and phytates have been removed.

Claim 98 (previously added) The method of claim 81 wherein said slurry is treated with an acid phosphatase at a pH of from about 3 to about 6.

Claim 99 (previously added) The method of claim 98 wherein said slurry is treated with an acid phosphatase at a pH of from about 3.5 to about 5.5.

Claim 100 (previously added) The method of claim 98 wherein said slurry is treated with an acid phosphatase at a pH of from about 4 to about 5.

Claim 101 (previously added) The method of claim 98 wherein said slurry is treated with an acid phosphatase at a pH of from about 4.4 to about 4.6.

Claim 102 (previously added) The method of claim 81 wherein said slurry is treated with an acid phosphatase at a temperature of from about 20°C to about 70°C.

Claim 103 (previously added) The method of claim 102 wherein said slurry is treated with an acid phosphatase at a temperature of from about 40°C to about 55°C.

Claim 104 (previously added) The method of claim 81 wherein said slurry is treated with an acid phosphatase wherein said acid phosphatase has an activity of about 600 KPU/g of curd solids to about 1400 KPU/g of curd solids.

Claim 105 (previously added) The method of claim 81 wherein said slurry is treated with an acid phosphatase wherein said acid phosphatase is present in said slurry in an amount of from about 0.1% to about 10% of the protein material, by weight.

Claim 106 (previously added) The method of claim 105 wherein said slurry is treated with an acid phosphatase wherein said acid phosphatase is present in said slurry in an amount of from about 0.3% to about 5% of the protein material, by weight.

Claim 107 (previously added) The method of claim 81 wherein said slurry is treated with said acid phosphatase for a period of from about 30 minutes to about 4 hours.

Claim 108 (previously added) The method of claim 107 wherein said slurry is treated with said acid phosphatase for a period of from about 45 minutes to about 3 hours.

Claim 109 (previously added) The method of claim 81 further comprising a step of drying said treated and washed slurry to provide a purified soy protein material.

Claim 110 (previously added) The method of claim 81 further comprising a step of heat treating said treated slurry.

Claim 111 (previously added) The method of claim 81 further comprising a step of treating said washed and acid phosphatase treated soy protein material slurry with a protease enzyme at a temperature, a pH, and for a time period sufficient to hydrolyze said protein in said slurry.

Claim 112 (previously added) The method of claim 111 wherein said protease enzyme is present in said slurry in a concentration of from about 0.1% to about 10% of the protein material in said slurry by dry weight.

Claim 113 (previously added) The method of claim 111 further comprising the step of heat treating the hydrolyzed protein slurry.

Claim 114 (previously added) The method of claim 111 further comprising the step of drying the hydrolyzed protein material after hydrolysis with said protease enzyme.

Claim 115 (previously added) The method of claim 81 wherein said treatment of said soy protein soy protein material slurry with an enzyme preparation containing an acid phosphatase and said wash of said treated slurry are effective to lower the mineral content in the soy protein material.

Claim 116 (previously added) The method of claim 81 wherein said soy protein material is washed by diluting said treated slurry with water and subsequently removing at least a portion of said diluent from said soy protein material.

Claim 117 (previously added) A method of producing a soy protein material comprising, treating an aqueous slurry of a soy protein material with an enzyme preparation containing an acid phosphatase enzyme at a temperature, a pH, and for a time period effective for said enzyme preparation to degrade ribonucleic acids in the soy protein material.

Claim 118 (previously added) The method of claim 117 wherein said soy protein material is a soy protein concentrate or a soy protein isolate.

Claim 119 (previously added) The method of claim 117 wherein treatment of the slurry with said enzyme preparation is effective to degrade a majority of ribonucleic acids in the soy protein material.

Claim 120 (previously added) The method of claim 117 wherein treatment of the slurry with said enzyme preparation is effective to degrade at least 80% of ribonucleic acids in the soy protein material.

Claim 121 (previously added) The method of claim 117 wherein said enzyme preparation is effective to degrade phytic acid and phytates in said soy protein material.

Claim 122 (previously added) The method of claim 117 wherein said slurry is treated with an enzyme preparation containing an acid phosphatase at a pH of from about 3 to 6.

Claim 123 (previously added) The method of claim 117 wherein said slurry is treated with an enzyme preparation containing an acid phosphatase at a temperature of from about 20°C to about 70°C.

Claim 124 (previously added) The method of claim 117 wherein said slurry is treated with an enzyme preparation containing an acid phosphatase wherein said enzyme preparation has an activity of greater than 500 KPU/kg of protein material in said slurry.

Claims 125-132 (cancelled)

**EXHIBIT A**

**BASF Aktiengesellschaft****BASF**

## The natural key to higher yields

**natuphos®**

### The original phytase

**Natuphos® offers the following benefits:**

- Improvement of phosphorus digestibility in pig and poultry diets
- Quantified improvement of nutrient digestibility and energetic value of feed
- Saving of feed costs due to reduction of expensive feed ingredients in the feed formula
- Reduced excretion of phosphorus (over 30 % less)
- Outstanding bioefficacy

**Natuphos® is available in a wide range of product formulations, providing powder, granule or liquid products of different phytase concentrations:****Natuphos® 5000****Natuphos® 5000 G****Natuphos® 5000 L****Natuphos® 10000 G\*****Natuphos® 10000 L\***

### The original phytase

The development of Natuphos® was prompted by environmental problems in regions with high livestock density. Its microbial 3-phytase, obtained from *Aspergillus niger*, releases phosphorus from phytate, the storage form of phosphorus in vegetable feed compounds, which is more or less undigestible to pigs and poultry.

Thus, supplementation of feed with Natuphos® markedly increases the availability of phosphorus but also of other phytate-bound minerals and nutrients. Released from phytate, these nutrients can be efficiently used by the animal instead of being lost with the manure.

### Reliable efficiency

The use of Natuphos® ensures a maximum release of digestible phosphorus from vegetable feedstuffs per phytase unit. Numerous feeding trials have shown the superior bioefficacy of Natuphos® compared to competitor products based on *Peniophora lycii* phytase. The mean exchange rate of Natuphos® versus Peniophora phytase in liquid products amounts to 1:1.5, in granular products it is at least 1:2.

### Less phosphorus in the manure

Since Natuphos® improves phosphorus digestibility, feed supplementation with inorganic phosphorus can be reduced. In this way, Natuphos® decreases the excretion of phosphorus by over 30 %, providing ecological and economical benefits.

### Feed optimisation with Natuphos®

Based on the results of numerous feeding trials, nutrient equivalencies have been

Our current product portfolio comprises:

**Natuphos®****Natugrain®****Natuphos Combi®****Natustarch®****Screensaver****BASF  
Aktiengesellschaft****DSM**

developed for Natuphos®. These figures express the extent to which nutrients are released by Natuphos® from phytate in the feed. They can be used in the same way as analysed nutrient contents of feed compounds to optimise least cost formulas. Feed optimisations reveal the economic advantages which can be gained by supplementing rations with Natuphos®.

#### Natuphos® formulations

Different formulations and concentrations of Natuphos® help to meet the customers' individual requirements for the manufacturing of quality feed under different production conditions:

##### POWDER

###### Natuphos® 5000:

fine, yellowish brown powder, recommended for use in non-pelleted compound feed and feed pelleted below 75°C  
min. 5.000 FTU/g phytase activity

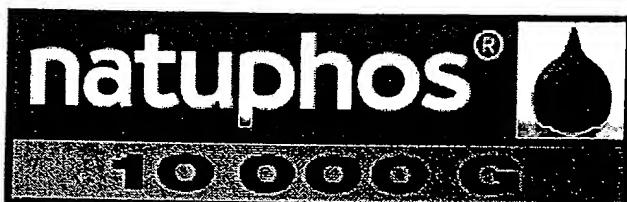
##### GRANULES

###### Natuphos® 5000 G:

fine white granules, recommended for use in compound feed pelleted up to 85°C  
min. 5.000 FTU/g phytase activity

###### Natuphos® 10000 G\*:

highly concentrated, fine white granules, recommended for use in concentrated premixes and in compound feed pelleted up to 85°C  
min. 10.000 FTU/g phytase activity



##### LIQUIDS

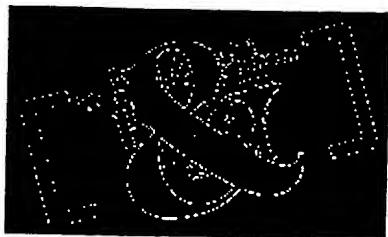
###### Natuphos® 5000 L:

yellowish brown liquid, recommended for use in compound feed pelleted above 85°C (post pelleting application)  
min. 5.000 FTU/g phytase activity

###### Natuphos® 10000 L\*:

highly concentrated, yellowish brown liquid, recommended for use in compound feed pelleted above 85°C (post pelleting application)  
min. 10.000 FTU/g phytase activity

\*Available only outside the European Union



Natuphos®, Natugrain®, Natustarch® = registered trademarks of DSM N.V., Heerlen, NL.

Start

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**EXHIBIT B**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Examiner : Deborah K. Ware  
Group Art Unit: : 1651  
Applicants : Wong et al.  
Serial No. : 09/912,471  
Filed : July 24, 2001  
For : METHOD FOR PRODUCING ULTRAPURE PROTEIN  
MATERIALS

Hon. Commissioner of Patents and Trademarks  
Alexandria, VA 22313-1450

Dear Sir:

**DECLARATION UNDER 37 CFR §1.132**

Theodore M. Wong declares as follows:

1. I am an inventor of the subject matter of the above identified patent application.
2. I received a Bachelor of Arts Degree in Biology from Greensboro College in May, 1974, a Masters Degree in Microbiology from the University of Texas at Arlington in May 1976 and a Ph.D. Degree in Food Science/Food Biochemistry from Louisiana State University in May, 1982.
3. I have been employed by Solae, LLC, previously known as Protein Technologies International, Inc., since August 19, 1985, and currently hold the position of Senior Research Director, Product Development R&D.
4. Under my direction and control an experiment was conducted to determine the extent of degradation of phospho- and diphospho-ester nucleoside containing compounds in a soy protein material by an acid phosphatase enzyme preparation in comparison with NATUPHOS® phytase enzyme. Three samples of soy protein curd at pH 4.6 were prepared. The first sample was used as a control sample ("Control"), the second sample was dosed with an acid phosphatase enzyme preparation having an enzyme activity of 1400 KPU per Kg curd solids ("Acid Phosphatase") and the third sample was dosed with NATUPHOS® phytase

enzyme preparation having an enzyme activity of 1800 FTU per Kg curd solids ("Natuphos"). After dosing the second and third samples with their respective enzyme preparations, the three samples were heated to 50°C for two hours. A sample of each of the three samples was then treated with bacterial alkaline phosphatase to degrade monomeric nucleotides to monomeric nucleosides and then the free monomeric nucleoside content of the treated samples was measured. The resulting free monomeric nucleoside content provides a measure of the amount of monomeric nucleotides and monomeric nucleosides present in the sample ("Monomerics"). Another sample of each of the three samples was treated with a nuclease to hydrolyze polymeric ribonucleic acids to monomeric nucleotides, then was treated with pyrophosphatase to hydrolyze ribonucleoside containing adducts to monomeric nucleotides, then was treated with bacterial alkaline phosphatase to hydrolyze the monomeric nucleotides to free monomeric nucleosides, and then the free monomeric nucleoside content of the treated samples was measured. The resulting free monomeric nucleoside content provides a measure of the total amount of ribonucleoside containing compounds, both polymeric and monomeric, since the nuclease and pyrophosphatase treatments degrade the polymeric ribonucleoside-containing compounds to monomeric nucleotides, which are subsequently degraded to monomeric nucleosides with bacterial alkaline phosphatase ("Total"). The resulting ribonucleoside content by weight of nucleosides for each sample is shown in Table 1.

TABLE 1

Sample	Uridine	Cytidine	Guanosine	Adenosine	Total
<b>Control</b>					
--Monomerics	172	121	237	127	657
--Total	4302	5320	6711	5886	22219
<b>Acid Phosphatase</b>					
--Monomerics	5188	6886	7175	2204	21453
--Total	5281	7015	7599	2495	22390
<b>Natuphos</b>					
--Monomerics	231	128	240	184	783
--Total	4542	5628	6866	6070	23106

Table 1 shows that treatment with the acid phosphatase enzyme preparation produced a soy material product in which 95.8% [(21453/22390)\*100] of all ribonucleoside containing compounds were either in their monomeric nucleoside form or their monomeric nucleotide form—clearly indicating the degradation of most polymeric ribonucleic acids in the soy material. Table 1 also shows that treatment with the NATUPHOS® phytase enzyme produced a soy material product in which 3.3% [(783/23106)\*100] of all ribonucleoside containing products were either in their monomeric nucleoside form or their monomeric nucleotide form. The NATUPHOS® phytase enzyme degraded little or no polymeric ribonucleic acids, as can be shown by comparing amount of monomeric nucleosides and monomeric nucleotides in the soy material treated with NATUPHOS® to the Control, which contained 3.0% [(657/22219)\*100] of all ribonucleoside containing products as monomeric nucleosides or monomeric nucleotides. NATUPHOS®, therefore, clearly did not degrade substantial amounts of ribonucleic acids to monomeric nucleosides or monomeric nucleotides, while the acid phosphatase enzyme preparation degraded almost all polymeric ribonucleoside-containing compounds to monomeric nucleosides and monomeric nucleotides.

5. Under my direction and control an experiment was conducted to determine the extent of degradation of phytic acid in a soy protein material by an acid phosphatase enzyme preparation in comparison with NATUPHOS® phytase enzyme. Three samples of soy protein curd at pH 4.6 were prepared. The first sample was used as a control sample ("Control"), the second sample was dosed with an acid phosphatase enzyme preparation having an enzyme activity of 1400 KPU per Kg curd solid ("Acid Phosphatase") and the third sample was dosed with NATUPHOS® phytase enzyme preparation having an enzyme activity of 1800 FTU per Kg curd solids ("Natuphos"). After dosing the second and third samples with their respective enzyme preparations, the three samples were heated to 50°C for two hours. A sample of each of the three samples was then analyzed to

determine phytic acid content, by weight percent of the soy protein material. The results are shown in Table 2.

TABLE 2

Sample	Phytic Acid (wt. %)
Control	1.46
Acid Phosphatase	0.12
Natuphos	0.11

Table 2 shows that both NATUPHOS® and the acid phosphatase enzyme preparation were effective to degrade phytic acid in a soy protein material relative to a soy protein material not treated with either enzyme. Tables 1 and 2, together, show that NATUPHOS® is effective to degrade phytic acid but not polymeric ribonucleoside-containing compounds such as ribonucleic acid, while an acid phosphatase enzyme preparation is effective to degrade both phytic acid and polymeric ribonucleoside-containing compounds such as ribonucleic acid.

Theodore M. Wong  
Theodore M. Wong

Date: July 1, 2003

**EXHIBIT C**

LEXSEE 212 USPQ 323

IN RE JOHN A. OELRICH ET AL.

Appeal No. 81-564.

UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

*666 F.2d 578; 1981 CCPA LEXIS 153; 212 U.S.P.Q. (BNA) 323*

Oral argument on October 9, 1981

December 10, 1981

**PRIOR HISTORY:** [\*\*1]

Serial No. 452,050.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Appellant sought review of the decision of the United States Patent and Trademark Office Board of Appeals sustaining the patent examiner's rejection under 35 U.S.C.S. § 102 of a claim in appellant's application for an apparatus specially adapted for moving low inertia steering fins on guided missiles.

**OVERVIEW:** Appellant's claim for an apparatus specially adapted for moving low inertia steering fins on guided missiles was rejected by the patent examiner. The United States Patent and Trademark Office Board of Appeals (the board) affirmed the rejection concluding that under 35 U.S.C.S. § 102, the claim was anticipated by a patent previously issued to appellant. Appellant sought review, and the appellate court reversed. The appellate court concluded that the determinative issue was a question of inherency. The board contended that the apparatus of the previously issued patent inherently performed the function of the apparatus of the rejected claim. The appellate court stated the principle that mere recitation of a newly discovered function or property, inherently possessed by things in the prior art, does not distinguish a claim drawn to those things from the prior

art. However, the court determined that in this case the rejected claim did not merely recite a newly discovered function of the old device. The appellate court concluded that there was no inherency, because the rejected claim contained a limitation that was not inherently present in the device of the previously issued patent.

**OUTCOME:** The rejection of appellant's claim was reversed, because the claim did not merely recite a newly discovered function of the device in a previously issued patent and contained a limitation that was not inherently present in the device in the previously issued patent.

**LexisNexis(R) Headnotes**

*Civil Procedure > Preclusion & Effect of Judgments > Collateral Estoppel*

*Civil Procedure > Preclusion & Effect of Judgments > Res Judicata*

*Patent Law > Jurisdiction & Review > Subject Matter Jurisdiction > Appeals*

[HN1] Res judicata does not have its usual impact when considering ex parte patent appeals; the public interest in granting valid patents outweighs the public interest underlying collateral estoppel and res judicata, particularly where the issue presented is not substantially identical to that previously decided.

*Patent Law > Jurisdiction & Review > Subject Matter Jurisdiction > Appeals*

666 F.2d 578, \*; 1981 CCPA LEXIS 153, \*\*;  
212 U.S.P.Q. (BNA) 323

**Patent Law > Anticipation & Novelty > General Overview**

[HN2] It is true that mere recitation of a newly discovered function or property, inherently possessed by things in the prior art, does not distinguish a claim drawn to those things from the prior art.

**Patent Law > Jurisdiction & Review > Subject Matter Jurisdiction > Appeals**

**Patent Law > Anticipation & Novelty > General Overview**

[HN3] Inherency may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

**COUNSEL:**

Roger A. VanKirk, attorney for appellant.

Joseph F. Nakamura, Solicitor, and Thomas E. Lynch, Associate Solicitor, for the Patent and Trademark Office.

**OPINIONBY:**

RICH

**OPINION: [\*579]**

Before MARKEY, Chief Judge, RICH, BALDWIN, MILLER, and NIES, Associate Judges.

RICH, Judge.

This appeal is from the decision of the United States Patent and Trademark Office (PTO) Board of Appeals (board) sustaining the examiner's rejection of claim 1 in application serial No. 452,050, filed March 18, 1974, entitled "Sub-Critical Time Modulated Control Mechanism," under 35 USC 102 as anticipated by appellant Oelrich's U.S. patent No. 3,430,536 for "Time Modulated Pneumatically Actuated Control Mechanism," issued March 4, 1969. We reverse.

**Background**

This application was the subject of *In re Oelrich*, 579 F.2d 86, 198 USPQ 210 (CCPA 1978), in which a rejection of claims 1-5 under 35 USC 103 was reversed. Appellant's method claims 2-5 now stand allowed.

The invention of claim 1 is directed to an apparatus specially adapted for moving low inertia steering fins on

guided missiles. The prior art apparatus and the theory upon which it operates are fully [\*\*2] discussed in our above prior opinion and will, therefore, not be repeated here. Generally, the claimed device responds to an electric signal from a missile guidance system, the magnitude of which is proportional to the desired amount of course-correcting fin movement, and converts the signal into a pneumatic pressure of appropriate magnitude which acts on a piston to move the missile guiding fin. The device which is the subject of the Oelrich patent "was employed only with the then available steering fins which they characterize as 'high inertia' loads." n1 The frequency at which this "high inertia" load system is operated is stated to be above the critical (resonant) frequency of the system. 579 F.2d at 87-89, 198 USPQ at 212-13. The allowed method claims and apparatus claim 1 direct use of a carrier frequency below the critical frequency of the system.

n1 While the solicitor equates "low-inertia" with a "relatively light load" and "high-inertia" with a "relatively heavy load," appellants are not as unequivocal. They refer to "small inertia" and "low inertia" loads, but, for example, the Divigard affidavit refers to "Fin Inertia" in terms of "in-1b sec<sup>2</sup>/rad," a unit of measure applicable only in referencing moment of inertia, not inertia. The difference is significant because inertia, measured in terms of mass, is closely related to weight, while moment of inertia is affected by the distribution of the mass. Because of this ambiguity, we cannot and do not use the terms "weight" and "inertia" interchangeably. [\*\*3]

Claim 1 reads (emphasis ours):

1. A time modulated fluid actuated control apparatus comprising:

housing means, said housing means defining a cylinder;

actuator piston means disposed in said housing means cylinder, said piston means including an output member adapted to be connected to a movable load, said load and control apparatus defining a system having a range of resonant frequencies;

solenoid operated valve means mounted on said housing means, said valve means being selectively operable to deliver pressurized fluid to and to vent fluid from said housing means cylinder at one side of said piston means;

means of generating variable input command signals commensurate with the desired position of the load, said

666 F.2d 578, \*; 1981 CCPA LEXIS 153, \*\*;  
212 U.S.P.Q. (BNA) 323

command signals being characterized by a dynamic frequency range below said range of said resonant frequencies;

means for generating a signal at a carrier frequency, said carrier frequency being greater than the maximum dynamic command signal frequency and less than the minimum system resonant frequency; [\*580]

means for modulating said carrier frequency signal by said command signals; and

means responsive to said modulated carrier frequency signal for [\*\*4] controlling energization of said solenoid operated valve means.

In sustaining the examiner's rejection under § 102, the board expressed agreement with his reasoning, which is here summarized. Stating that "the issue is identical to that decided in *In re Ludike*, 58 CCPA 1159, 441 F.2d 660, 169 USPQ 563 (1971)," the examiner noted that, for purposes of determining inherency, "the question is, does Oelrich [the reference patent] disclose a signal generator that necessarily must supply the carrier frequencies that appellants use?" The examiner turned to Exhibit A of coapplicant Divigard's affidavit, which states as an assumption in a "Linearized Simulation" of a "high inertia" load system that the critical resonance frequency must be kept below 80 Hz to avoid interaction with the carrier frequency which is between 100 and 150 Hz. Thus, the examiner concluded, "Exhibit A establishes Oelrich's carrier frequency range, which may now be compared with the carrier frequency range of applicants' low-inertia system." It was then asserted that the Oelrich and Kolk affidavits establish that good low inertia system design practice dictates a carrier frequency range of 95-190 Hz. Since the [\*\*5] carrier frequency range for the high inertia system lies within the range for the low inertia system, and since the critical frequency of the low inertia system is near the solenoid limit of 175 Hz, the examiner posited that the Oelrich carrier frequencies would be sub-critical in the low inertia system, saying, "Thus Oelrich's signal generator does in fact inherently produce frequencies which would be sub-critical when used with a low-inertia system, and therefore, inherently supplies a carrier frequency range which is usable in applicants' system since this conclusion was deduced from specific data presented in the patent and in the affidavits supplied by appellants." The appellants also asserted our prior decision was res judicata.

#### OPINION

Although appellants' arguments on appeal are directed primarily to a discussion of res judicata n2 and whether a "product which is unwittingly produced is anticipation," resolution of this case is properly had by comparison of the reference patent to the limitations of

claim 1. As will appear, the determinative issue is a question of inherency.

n2 The doctrine of res judicata, argued in view of our decision in *In re Oelrich*, 579 F.2d 86, 198 USPQ 210 (CCPA 1978), is not applicable to the instant rejection. The issue in the former case was obviousness; here it is anticipation. A new rejection is before us. Furthermore, [HN1] res judicata does not have its usual impact when considering ex parte patent appeals; the public interest in granting valid patents outweighs the public interest underlying collateral estoppel and res judicata, particularly where the issue presented is not substantially identical to that previously decided. *In re Russell*, 58 CCPA 1081, 1083, 439 F.2d 1228, 1230, 169 USPQ 426, 428 (1971); *In re Craig*, 56 CCPA 1438, 1441-42, 411 F.2d 1333, 1335-36, 162 USPQ 157, 159 (1969). [\*\*6]

The distinguishing feature of claim 1 is defined in the paragraph which states that the apparatus contains a

means for generating a \* \* \* carrier frequency \* \* \* greater than the maximum dynamic command signal frequency and less than the minimum system resonant frequency. n3

n3 Emphasis is ours. Portions of the claim unnecessary to this discussion have been omitted for clarity.

Given that the carrier frequency which can be used in a low inertia system may fall within the range of carrier frequencies usable in a high inertia system (appellants admit as much), the PTO urges that the apparatus of the Oelrich patent inherently performs the function of the apparatus of claim 1, and that finding a new use for an old device does not entitle one to an apparatus claim for that device, citing *In re Wiseman*, 596 F.2d 1019, 201 USPQ 658 (CCPA 1979). Appellants in that case argued, however, that a structure suggested [\*581] by the prior art was patentable to them because it also possessed an inherent but unknown function which they claimed to have discovered. This court stated that a "patent on such a structure would remove from the public that which is in the public domain by [\*\*7] virtue of its inclusion in, or obviousness from, the prior art." *Id.* at 1023, 201 USPQ at 661.

Appellants here countered the PTO inherency contention at oral argument (no reply brief was filed) by urging that there is no "inherency" because there is no "inevitability," that is, the previously quoted "means plus

666 F.2d 578, \*; 1981 CCPA LEXIS 153, \*\*;  
212 U.S.P.Q. (BNA) 323

function" limitation of claim 1 is not inherently (always) present in the device of the Oelrich patent.

[HN2] It is true that mere recitation of a newly discovered function or property, inherently possessed by things in the prior art, does not distinguish a claim drawn to those things from the prior art. *In re Swinehart*, 58 CCPA 1027, 1031, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (1971). In this case, however, claim 1 does not merely recite a newly discovered function of an old device. *In re Chandler*, 45 CCPA 911, 254 F.2d 396, 117 USPQ 361 (1958), a case not cited by either party to this appeal, is most pertinent to the instant controversy.

The claim in Chandler, *id. at 912-13, 254 F.2d at 397, 117 USPQ at 361-62*, drawn to an automatic control for a jet engine, included a "means responsive to said movement for regulating the propulsive power of said engine, in accordance [\*\*8] with said movement, so that said aircraft is propelled at a definite, selected speed, corresponding to the position of said engine relative to said aircraft, throughout the speed range of said aircraft." (Emphasis added.) In refuting the examiner's argument that the words beginning with "so that" were merely functional, and thus did not distinguish the device from that claimed in a patent to Goddard, this court stated:

\* \* \* the expression beginning with "so that" is not merely functional, but constitutes a part of the definition of the "means responsive to said movement." Thus that means is defined as being responsive to the movement of the engine in such a way that the aircraft will be propelled at a definite speed in the manner specified. Such a definition conforms to the provision of 35 U.S.C. 112 that an element in a claim for a combination "may be expressed as a means or step for performing a specified function without the recital of structure, material or acts in support thereof. n4

n4 For a similar case, see *In re Wilson*, 53 CCPA 1141, 1148-49, 359 F.2d 456, 461, 149

USPQ 523, 527 (1966). The provision of § 112 referred to is, of course, the sixth paragraph, formerly, at the times of Chandler and Wilson, the third paragraph. The change occurred January 24, 1978. [\*\*9]

Likewise, the words after "means for generating a \* \* \* carrier frequency" in the claim on appeal constitute a limiting definition of the means. The PTO does not contend that this limitation, a carrier frequency which is "less than the minimum mum system resonant frequency," is expressly disclosed in the Oelrich patent. Neither, however, is this limitation inherent therein. In *Hansgirg v. Kemmer*, 26 CCPA 937, 940, 102 F.2d 212, 214, 40 USPQ 665, 667 (1939), the court said:

[HN3] Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. [Citations omitted.] If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

The relationship between the carrier frequency and the system critical frequency -- the former below the latter (and expressly made a claim limitation by use of "means plus function" language) -- cannot be said to be "the natural result flowing from the operation [\*\*10] as taught." The Oelrich patent instructs that the device is "adapted to receive a carrier frequency substantially in [\*582] excess of the particular system critical or resonant frequency \* \* \*." Given this express teaching, a "means for generating a \* \* \* carrier frequency \* \* \* less than the minimum system resonant frequency" is not inevitably present.

The decision of the board is reversed.

REVERSED

**EXHIBIT D**

LEXSEE 52 USPQ 2D 1303

**MEHL/BIOPHILE INTERNATIONAL CORP., SELVAC ACQUISITIONS CORP.  
and NARDO ZAIAS, M.D., Plaintiffs-Appellants, v. SANDY MILGRAUM, M.D.,  
PALOMAR MEDICAL TECHNOLOGIES, INC., and SPECTRUM MEDICAL  
TECHNOLOGIES, INC., Defendants-Appellees.**

99-1038

**UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT**

***192 F.3d 1362; 1999 U.S. App. LEXIS 24277; 52 U.S.P.Q.2D (BNA) 1303***

**September 30, 1999, Decided**

**SUBSEQUENT HISTORY:** Rehearing Denied October 27, 1999, Reported at: *1999 U.S. App. LEXIS 31386*.

**PRIOR HISTORY:** [\*\*1]Appealed from: United States District Court for the District of New Jersey. Judge Alfred M. Wolin.

**DISPOSITION:** AFFIRMED.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Plaintiff medical device companies appealed an order from the United States District Court for the District of New Jersey dismissing their patent infringement action against defendant competitor on the ground that all of plaintiffs' patent claims were anticipated by prior art references.

**OVERVIEW:** Plaintiff medical device companies sued defendant competitor for infringement of a process patent for removing hair using a laser. Plaintiffs' claims were dismissed by summary judgment on the ground that all of the claims in plaintiffs' patent were anticipated by two prior art references, an instruction manual and an article, the manual being the dispositive anticipating reference. On appeal, the court upheld the dismissal, but concluded that the manual reference did not anticipate because it did not teach all the limitations of the claimed invention. However, there was no question of probabilities as to whether a person of ordinary skill following the teachings of the article would align the laser light applicator over a hair follicle as taught in the article reference. Thus, the article prior reference

disclosed all of the elements of plaintiffs' claimed invention and its claims, including the dependent claims that were not argued separately, were invalid.

**OUTCOME:** Summary judgment for defendant affirmed; the article prior art reference anticipated claim one of the allegedly infringed patent in that a person of ordinary skill following the teaching of the article would align the laser light as taught in the reference and claimed in the invention; dependent claims were accordingly invalid.

**LexisNexis(R) Headnotes**

***Civil Procedure > Summary Judgment***

***Civil Procedure > Appeals > Standards of Review***

[HN1] The appellate court reviews a district court's grant of summary judgment by reapplying the standard applicable at the district court.

***Civil Procedure > Summary Judgment > Summary Judgment Standard***

[HN2] Summary judgment is appropriate only when there is no genuine issue as to any material fact and the moving party is entitled to a judgment as a matter of law. *Fed. R. Civ. P. 56(c)*. In its review, the appellate court draws all reasonable inferences in favor of the non-movant.

***Patent Law > Anticipation & Novelty > General Overview***

[HN3] To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either

192 F.3d 1362, \*; 1999 U.S. App. LEXIS 24277, \*\*;  
52 U.S.P.Q.2D (BNA) 1303

explicitly or inherently. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient. Thus, a prior art reference may anticipate when the claim limitation or limitations not expressly found in that reference are nonetheless inherent in it.

**Patent Law > Anticipation & Novelty > General Overview**

[HN4] Under the principles of inherency, if the prior art necessarily functions in accordance with, or includes, the claimed limitations, it anticipates. Inherency is not necessarily coterminous with the knowledge of those of ordinary skill in the art. Artisans of ordinary skill may not recognize the inherent characteristics or functioning of the prior art.

**Patent Law > Anticipation & Novelty > General Overview**

[HNS5] Occasional results are not inherent.

**Civil Procedure > Appeals > Reviewability > Preservation for Review**

[HN6] Appellees always have the right to assert alternative grounds for affirming the judgment that are supported by the record.

**Patent Law > Anticipation & Novelty > General Overview**

[HN7] Where the result is a necessary consequence of what was deliberately intended, it is of no import that the reference article's authors did not appreciate the results.

**COUNSEL:** Jeffrey A. Schwab, Abelman, Frayne & Schwab, of New York, New York, argued for plaintiffs-appellants. With him on the brief were Michael Aschen and Anthony J. DiFilippi. Of counsel on the brief was George A. Arkwright, Schlesinger, Arkwright & Garvey, LLP, of Arlington, Virginia.

Wayne L. Stoner, Hale and Dorr, LLP, of Boston, Massachusetts, argued for defendants-appellees. With him on the brief were William F. Lee and James M. Hall. Of counsel on the brief was Thomas A. Reed, Palomar Medical Technologies, Inc., of Lexington, Massachusetts.

**JUDGES:** Before MAYER, MICHEL, and RADER, Circuit Judges.

**OPINIONBY: RADER**

**OPINION: [\*1363]**

RADER, Circuit Judge.

In this patent infringement action, MEHL/Biophile International Corp., Selvac Acquisitions Corp., and Dr. Nardo Zaias (collectively, MEHL/Biophile) asserted that Dr. Sandy Milgraum, Palomar Medical Technologies, Inc., and Spectrum Medical Technologies, Inc. (Milgraum) infringed U.S. Patent No. 5,059,192 (the '192 patent). On its motion for summary judgment, Milgraum contended that all of the '192 patent claims were anticipated [\*\*2] by an instruction manual for the Spectrum RD-1200 laser and by a 1987 Journal of Investigative Dermatology article authored by Dr. Luigi Polla and others (the Polla article). The district court agreed that the manual anticipated the claims, granted summary judgment of invalidity, and dismissed the action. See MEHL/Biophile Int'l [\*1364] Corp. v. Milgraum, 8 F. Supp. 2d 434, 47 U.S.P.Q.2D (BNA) 1248 (D.N.J. 1998). Although this court disagrees that the manual discloses all the elements of the claimed invention, because the Polla article does, this court affirms.

I.

The '192 patent, entitled "Method of Hair Depilation," claims a method for removing hair using a laser. Hairs grows out of hair follicles, tubular apertures in the skin. The collection of germ cells from which hairs grow, known as the papilla, lies at the base of the follicle. The '192 patent claims a method for destroying the papilla, thereby preventing hair regrowth. The written description discloses the use of a Q-switched ruby laser to effect the destruction.

At a meeting of the American Academy of Dermatology, Dr. Zaias visited Spectrum's booth where Spectrum displayed such a laser, known as the RD-1200. Spectrum sold [\*\*3] the RD-1200 for use in removing tattoos. Dr. Zaias recognized that the same principles that govern laser absorption in skin pigmented by a tattoo would also focus laser absorption on the natural skin pigment found in the papilla. More specifically, the papilla contains granules (called melanosomes) of a dark pigment (called melanin). A Q-switched ruby laser aimed at the hair follicle will penetrate the skin and reach the papillary melanin. At a particular wavelength, the laser will heat up and destroy the papilla without damaging surrounding tissue.

Claim 1 of the patent, the only independent claim, reads:

192 F.3d 1362, \*; 1999 U.S. App. LEXIS 24277, \*\*;  
52 U.S.P.Q.2D (BNA) 1303

1. A method of hair depilation, comprising the steps of:

- a) aligning a laser light applicator substantially vertically over a hair follicle opening, said applicator having an aperture of sufficient area to surround a hair follicle and overlie its papilla;
- b) applying through said aperture to the hair follicle a pulse of laser energy of a wavelength which is readily absorbed by the melanin of the papilla and having a radiant exposure dose of sufficient energy and duration to damage its papilla so that hair regrowth is prevented and scarring of the surrounding skin [\*\*4] is avoided.

Dependent claims 2-6 further specify parameters of the laser light applicator, energy delivery, and the type of laser.

MEHL/Biophile sued Milgraum in the United States District Court for the District of New Jersey for infringement of all the claims of the '192 patent. Milgraum moved for summary judgment of invalidity based on 35 U.S.C. § 102 (1994), arguing that two prior art references each teach all the limitations of the claims. As noted at the outset, Milgraum relied on the manual for the RD-1200 laser which describes the use of a laser to remove tattoos. The manual teaches the use of a Q-switched ruby laser to remove a tattoo: "Energy is selectively absorbed only by pigmented chromophores and not surrounding tissue, greatly reducing the risk of scarring."

Milgraum also relied on the Polla article entitled "Melanosomes Are a Primary Target of Q-Switched Ruby Laser Irradiation in Guinea Pig Skin." The Polla article documents "the tissue damage induced by Q-switched ruby laser pulses in black, brown, and albino (control) guinea pigs . . . in an effort to define the nature and extent of pigmented cell injury." The method involves epilating [\*\*5] guinea pigs with soft wax, holding the aperture of the laser in contact with the skin, and pulsing the laser. Using an electron microscope, the researchers observed "disruption of melanosomes deep in the hair papillae."

The district court considered both references, but ultimately rested its decision on the RD-1200 manual. MEHL/Biophile appeals. MEHL/Biophile makes several arguments for disregarding the manual as an anticipating reference. For instance, MEHL/Biophile argues that the manual does not teach use of the laser to remove hair at all. Further MEHL/Biophile contends that the manual does not disclose a substantially vertical alignment, a

claim element. As for the Polla article, [\*1365] MEHL/Biophile argues that the reference relates to guinea pig skin and does not mention hair depilation. In addition, MEHL/Biophile contends that the epilation of the guinea pig backs removed the papilla so the laser treatment could not have damaged the papilla.

## II.

[HN1] This court reviews a district court's grant of summary judgment by reapplying the standard applicable at the district court. See *Conroy v. Reebok Int'l, Ltd.*, 14 F.3d 1570, 1575, 29 U.S.P.Q.2D (BNA) 1373, 1377 (Fed. Cir. 1994). [HN2] Summary [\*\*6] judgment is appropriate only when "there is no genuine issue as to any material fact and . . . the moving party is entitled to a judgment as a matter of law." Fed. R. Civ. P. 56(c). In its review, this court draws all reasonable inferences in favor of the non-movant. See *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 255, 91 L. Ed. 2d 202, 106 S. Ct. 2505 (1986).

[HN3] "To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently." *In re Schreiber*, 128 F.3d 1473, 1477, 44 U.S.P.Q.2D (BNA) 1429, 1431 (Fed. Cir. 1997). As this court's predecessor stated in *In re Oelrich*, 666 F.2d 578, 581, 212 U.S.P.Q. (BNA) 323, 326 (CCPA 1981) (quoting *Hansgirg v. Kemmer*, 26 C.C.P.A. 937, 102 F.2d 212, 214, 40 U.S.P.Q. (BNA) 665, 667 (CCPA 1939)) (internal citations omitted):

Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance [\*\*7] of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

Thus, a prior art reference may anticipate when the claim limitation or limitations not expressly found in that reference are nonetheless inherent in it. See *In re Oelrich*, 666 F.2d at 581; *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 630, 2 U.S.P.Q.2D (BNA) 1051, 1053 (Fed. Cir. 1987). [HN4] Under the principles of inherency, if the prior art necessarily functions in accordance with, or includes, the claimed limitations, it anticipates. See *In re King*, 801 F.2d 1324, 1326, 231

192 F.3d 1362, \*; 1999 U.S. App. LEXIS 24277, \*\*;  
52 U.S.P.Q.2D (BNA) 1303

*U.S.P.Q. (BNA) 136, 138 (Fed. Cir. 1986).* Inherency is not necessarily coterminous with the knowledge of those of ordinary skill in the art. Artisans of ordinary skill may not recognize the inherent characteristics or functioning of the prior art. See *id.*, 801 F.2d at 1326.

#### The RD-1200 Manual

The RD-1200 manual cannot anticipate because it does not teach all the limitations of the claimed invention. Claim 1 includes the step of "aligning a laser light applicator substantially vertically over a hair follicle opening." The parties agree [\*\*8] that the manual does not discuss hair follicles, let alone aligning the laser over a hair follicle opening. Thus, the manual does not explicitly teach alignment substantially vertically over a follicle opening. Without explicit teachings of this claim limitation, this court must nonetheless examine whether such alignment is inherent in the manual's disclosure.

The manual teaches aiming the laser at skin pigmented with tattoo ink. The record discloses no necessary relationship between the location of a tattoo and the location of hair follicles. Therefore, an operator of the RD-1200 laser could use the laser according to the manual without necessarily aligning the laser "substantially vertically over a hair follicle opening." The possibility of such an alignment does not legally suffice to show anticipation. See *In re Oelrich*, 666 F.2d at 581. [HN5] Occasional results are not inherent. Because this court holds that the manual does not inherently teach this limitation of the claimed invention, it does not address MEHL/Biophile's other arguments. To anticipate, a single reference must teach every limitation of the claimed invention. Without an inherent teaching about alignment, [\*\*9] the manual does not anticipate the claimed invention.

#### [\*1366] The Polla Article

Although the district court did not reach the Polla article in its anticipation analysis, [HN6] "appellees always have the right to assert alternative grounds for affirming the judgment that are supported by the record." *Datascope Corp. v. SMEC, Inc.*, 879 F.2d 820, 822 n.1, 11 U.S.P.Q.2D (BNA) 1321, 1322 n.1 (Fed. Cir. 1989). Milgram asserts that the Polla article constitutes such an alternative ground. This court agrees.

As to the "aligning" step, the Polla article does not suffer from the same deficiency as the manual. It is not a question of probabilities as to whether a person of ordinary skill following the teachings of the article will align the laser light applicator over a hair follicle. The researchers focused their study on the epilated backs of guinea pigs. No one disputes that guinea pigs have hairy backs. Indeed, the article itself is replete with references

to the irradiation of hair follicles and resulting follicular damage:

At 0.8 J/cm<sup>2</sup>, epidermal lesions were more marked and involved hair follicles 0.3 mm below the skin surface . . . . Lesions were also present 0.5 mm deep in follicles. [\*\*10]

Even at the highest radiant exposure (1.2 J/cm<sup>2</sup>), brown [guinea pig] skin never showed full-thickness epidermal necrosis and at 0.8 J/cm<sup>2</sup>, follicular damage was observed to a depth of 0.5 mm and at 1.2 J/cm<sup>2</sup> to a depth of 0.7 mm below the skin surface.

. . .

Follicular changes were similar in nature and extent to the epidermal alterations described above, and were associated with melanosome disruption.

. . .

Specifically, we have shown that . . . pigmented structures in the deep dermis such as hair follicles are affected . . . .

The article further contains a photograph showing "follicular changes induced by ruby laser." The changes include disruption of "melanosomes contained within follicular epithelium." Moreover the article specifically mentioned disruption of the hair papillae:

At 0.8 and 1.2 J/cm<sup>2</sup>, individual melanosomes were more intensely damaged and disruption of melanosomes deep in the hair papillae was observed.

Finally, the method of exposing the Q-switched ruby laser to the guinea pig skin also inherently teaches substantially vertical alignment over hair follicle openings:

The collimated laser beam struck a circular [\*\*11] aperture, 2.5 mm in diameter, held in contact with the skin of the animals.

The record shows that holding the collimated laser in contact with the skin would align it perpendicular to the

192 F.3d 1362, \*; 1999 U.S. App. LEXIS 24277, \*\*;  
52 U.S.P.Q.2D (BNA) 1303

skin surface and therefore substantially vertically over follicle openings. Viewed as a whole, this disclosure shows, in the words of *In re Oelrich*, 666 F.2d at 581, that the "natural result flowing from the operation as taught would result in" alignment of the laser light over a hair follicle, as claimed. No reasonable jury could find otherwise.

MEHL/Biophile's remaining arguments concerning the Polla article are unavailing. The Polla article concerns itself with guinea pig, rather than human, skin, but that difference is irrelevant to the anticipation analysis. Nothing in the claim limits the method's reach to human skin. Similarly, the Polla article's failure to mention hair depilation as a goal is similarly irrelevant. MEHL/Biophile does not dispute on appeal that the laser operating parameters disclosed in the article substantially coincide with those disclosed in the patent. Accordingly, to the extent the embodiment in the patent achieves hair depilation, so does the [\*\*12] Polla method. [HN7] Where, as here, the result is a necessary consequence of what was deliberately intended, it is of no import that the

article's authors did not appreciate the results. See *W.L. Gore & Assocs. v. Garlock, Inc.*, 721 F.2d 1540, 1548, 220 U.S.P.Q. (BNA) 303, 309 (Fed. Cir. 1983). Finally, as mentioned earlier, the article itself belies MEHL/Biophile's argument that the wax epilation prescribed by the article resulted in removal of the papilla. [\*1367] The article specifically states that "disruption of melanosomes deep in the hair papillae was observed." MEHL/Biophile's expert testimony contradicting the plain language of the reference does not create a genuine issue of fact.

Thus, the Polla article anticipates claim 1 of the '192 patent. Because MEHL/Biophile has not separately argued the validity of the dependent claims, the judgment of invalidity as to those claims also stands.

#### COSTS

Each party shall bear its own costs.

#### AFFIRMED

**EXHIBIT E**

LEXSEE 63 USPQ 2D 1597

**TRINTEC INDUSTRIES, INC., Plaintiff-Appellant, v. TOP-U.S.A.  
CORPORATION, Defendant-Appellee.**

**01-1568**

**UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT**

**295 F.3d 1292; 2002 U.S. App. LEXIS 13190; 63 U.S.P.Q.2D (BNA) 1597**

**July 2, 2002, Decided**

**PRIOR HISTORY:** [\*\*1]Appealed from: United States District Court for the Southern District of Ohio Senior Judge Joseph P. Kinneary.

**DISPOSITION:** Vacated and remanded.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Plaintiff patent assignee sued defendant company alleging infringement. The United States District Court for the Southern District of Ohio granted summary judgment in favor of the company on the grounds the patent was invalid as inherently anticipated. The patent assignee appealed.

**OVERVIEW:** The patent claimed a cost-effective method of producing, in low volume, multicolor faces for watches, clocks, thermometers and other instruments. The method included making a graphic instrument face in a computer, transmitting electronic signals from the computer to a color printer or photocopier, printing the face on sheet material, cutting it, and assembling it into an instrument. The company produced watches and clocks with customized faces. The company used color laser printers to make custom watches and clocks. A different manufacturer also was in the business of customized watches and advertised in a catalogue the availability at an inexpensive price of small-volume multi-color watches produced by a new computer laser printer. The district court found that the catalogue inherently anticipated the asserted claims and granted summary judgment of invalidity. The court of appeals held that given the strict identity required of the test for novelty, on the record no reasonable jury could conclude that the catalogue anticipated either expressly or

inherently the claim at issue. Because the record was not fully developed the issue of obviousness could not be reached.

**OUTCOME:** The judgment was vacated and the matter was remanded for a determination on the issue of obviousness and other proceedings consistent with the opinion.

**LexisNexis(R) Headnotes**

*Patent Law > Infringement Actions > Summary Judgment > Appeals*

*Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > General Overview*

*Patent Law > Anticipation & Novelty > Fact & Law Issues*

[HN1] Under patent law, an appeals court reviews a district court's grant of summary judgment without deference. An appeals court also reviews without deference questions of claim construction. Novelty, or anticipation, is a question of fact. Therefore, a district court properly may grant summary judgment on an identity question only when the record discloses no genuine material factual issues.

*Patent Law > Anticipation & Novelty > Elements*

*Patent Law > Infringement Actions > Claim Interpretation > Aids*

*Patent Law > Infringement Actions > Claim Interpretation > Construction Preferences*

[HN2] Under patent law with regard to a claim of infringement, because novelty's identity requirement applies to claims, not specifications the anticipation inquiry first demands a proper claim construction. Claim

295 F.3d 1292, \*; 2002 U.S. App. LEXIS 13190, \*\*;  
63 U.S.P.Q.2D (BNA) 1597

language defines claim scope. As a general rule, claim language carries the ordinary meaning of the words in their normal usage in the field of invention. Nevertheless, the inventor may act as his own lexicographer and use the specification to supply implicitly or explicitly new meanings for terms. Thus, a construing court may consult as well the written description, and, if in evidence, the prosecution history.

***Patent Law > Anticipation & Novelty > Accidental Anticipation & Inherency***

***Patent Law > Anticipation & Novelty > Elements***

***Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > General Overview***

[HN3] Under patent law, a single prior art reference anticipates a patent claim if it expressly or inherently describes each and every limitation set forth in the patent claim. Inherent anticipation requires that the missing descriptive material is "necessarily present," not merely probably or possibly present, in the prior art.

***Patent Law > Anticipation & Novelty > Accidental Anticipation & Inherency***

***Patent Law > Anticipation & Novelty > Elements***

[HN4] Under patent law, obviousness is not inherent anticipation. Though anticipation is the epitome of obviousness, they are separate and distinct concepts.

***Patent Law > Anticipation & Novelty > Elements***

***Patent Law > Nonobviousness > Elements & Tests > General Overview***

[HNS5] Under patent law, obviousness involves questions of suggestion to combine and objective indicators of patentability.

**COUNSEL:** Robert A. Vanderhye, Nixon & Vanderhye P.C., of Arlington, Virginia, argued for plaintiff-appellant.

David P. Shouvalin, Porter, Wright, Morris, & Arthur, LLP, of Columbus, Ohio, argued for defendant-appellee. On the brief was David W. Costello. Of counsel was Richard M. Mescher.

**JUDGES:** Before MAYER, Chief Judge, RADER, and GAJARSA Circuit Judges.

**OPINIONBY:** RADER

**OPINION:** [\*1293] Before MAYER, Chief Judge, RADER, and GAJARSA Circuit Judges.

RADER, Circuit Judge.

On summary judgment, the United States District Court for the Southern District of Ohio found Trintec

Industries, Inc.'s United States Patent No. 5,818,717 ('717 patent) invalid as inherently anticipated. *Trintec, Indus. v. Top-U.S.A. Corp.*, No. C-99-1179 (S.D. Ohio Jun. 19, 2001). Because the '717 patent is not inherently anticipated, this court vacates and remands.

I.

Trintec is the assignee of the '717 patent. The inventor, Brendon G. Nunes, [\*1294] filed the '717 patent application on June 2, 1993. The '717 patent claims a cost-effective method of producing, in low volume, multicolor faces for watches, clocks, [\*\*2] thermometers and other instruments. The method includes making a graphic instrument face in a computer, transmitting electronic signals from the computer to a color printer or photocopier, printing the face on sheet material, cutting it, and assembling it into an instrument.

Top-U.S.A. Corporation produces watches and clocks with customized faces, and has done so for over eighteen years. Initially, Top created and printed its customized graphics using pad printing, engraving, silk screening, or photography. Those methods were expensive and required extensive set-up time. Thus, these older methods were ill-suited to small-volume custom design and printing. Desktop publishing's advent in the late 1980s mitigated the design side of this problem, but high-resolution color printing remained prohibitively expensive. With color laser printer advances, however, Top was using that technology to make custom watches and clocks by 1995.

Sweda Company LLC also is in the customized watch business. In a 1991-92 catalogue (Sweda catalogue), Sweda advertised the availability at an inexpensive price of small-volume multi-color watches produced by "a new computer laser printer." The Sweda catalogue [\*\*3] was not before the examiner of the '717 patent during its prosecution.

On November 2, 1999, Trintec asserted the '717 patent against Top in the district court. Trintec alleged that Top infringed independent claims 3 and 8, and associated dependent claims 4-5, 12, and 13. Trintec filed a motion for summary judgment of infringement, intentional infringement, and validity. Top filed a cross-motion for summary judgment that the asserted claims either were anticipated or obvious in view of the Sweda catalogue. The district court found that the Sweda catalogue inherently anticipated the asserted claims and granted summary judgment of invalidity. Having determined that prior art anticipated the '717 patent, the district court did not reach obviousness and dismissed the case with prejudice. Trintec appeals the district court's summary judgment of invalidity. This court has jurisdiction under 28 U.S.C. § 1295(a)(1) (2000).

## II.

[HN1] This court reviews a district court's grant of summary judgment without deference. *Johns Hopkins Univ. v. Cellpro, Inc.*, 152 F.3d 1342, 1353, 47 U.S.P.Q.2D (BNA) 1705, 1713 (Fed. Cir. 1998). This court also reviews without deference questions [\*\*4] of claim construction. *Cybor Corp. v. FAS Techs., Inc.*, 138 F.3d 1448, 1454, 46 U.S.P.Q.2D (BNA) 1169, 1174 (Fed. Cir. 1998) (en banc). Novelty, or anticipation, is a question of fact. *Akzo N.V. v. United States Int'l Trade Comm'n*, 808 F.2d 1471, 1 U.S.P.Q.2D (BNA) 1241 (Fed. Cir. 1986). Therefore, a district court properly may grant summary judgment on this identity question only when the record discloses no genuine material factual issues.

[HN2] Because novelty's identity requirement applies to claims, not specifications, *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 7 U.S.P.Q.2D (BNA) 1057, 1064 (Fed. Cir. 1988), the anticipation inquiry first demands a proper claim construction. Claim language defines claim scope. *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 1121, 227 U.S.P.Q. (BNA) 577, 586 (Fed. Cir. 1985) (en banc). As a general rule, claim language carries the ordinary meaning of the words in their normal usage in the field of invention. *Toro Co. v. White Consol. Indus.*, 199 F.3d 1295, 1299, 53 U.S.P.Q.2D (BNA) 1065, 1067 (Fed. Cir. 1999). Nevertheless, [\*1295] the inventor may act as his own lexicographer and use the specification [\*\*5] to supply implicitly or explicitly new meanings for terms. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979-80, 34 U.S.P.Q.2D (BNA) 1321, 1330 (Fed. Cir. 1995) (en banc), aff'd, 517 U.S. 370, 134 L. Ed. 2d 577, 116 S. Ct. 1384 (1996). Thus, a construing court may consult as well the written description, and, if in evidence, the prosecution history. Id.

[HN3] A single prior art reference anticipates a patent claim if it expressly or inherently describes each and every limitation set forth in the patent claim. *Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 631, 2 U.S.P.Q.2D (BNA) 1051, 1053 (Fed. Cir. 1987). Inherent anticipation requires that the missing descriptive material is "necessarily present," not merely probably or possibly present, in the prior art. *In re Robertson*, 169 F.3d 743, 745, 49 U.S.P.Q.2D (BNA) 1949, 1950-51 (Fed. Cir. 1999) (citing *Continental Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 U.S.P.Q.2D (BNA) 1746, 1749 (Fed. Cir. 1991)).

In this case, the district court determined that the Sweda catalogue anticipated, or disclosed and enabled each and every element of, the claimed invention. [\*\*6] The Sweda catalogue advertises three different methods of making customized watches: a "full color watch

rendering" method, a "mock-up sample" method, and a "speculative sample" method. The catalogue states that the first two methods use a computer laser printer, and the "speculative samples" method uses silk-screening, hot stamping, color process/offset printing, etchograph stamping, or engraving. The catalogue then shows images of color watch faces made with each of the advertised methods. All three methods require the customer to submit "camera ready, color separated artwork," i.e., separate pieces of black and white artwork representing each color in the design.

Top concedes that the Sweda catalogue does not teach expressly all limitations of the asserted claims. Hence, the only issue for this court to determine is whether the claim limitations not taught expressly by the Sweda catalogue are nevertheless disclosed inherently. This inherent anticipation question implicates claims 3 and 8. Claim 3 recites, in relevant part:

3. A method of constructing a functional multicolor element having indicia thereon, utilizing a computer and a color photocopier, comprising the steps [\*\*7] of:

(a) electronically creating or providing in the computer an electronic simulation of the desired functional multicolor element, with indicia thereon;

(b) under the control of the computer, transmitting electronic signals from the computer to the photocopier so that the photocopier transforms the electronic simulation of the desired functional multicolor element onto a piece of sheet material . . . .

Col. 7, ll. 16-26 (emphases added).

The district court construed the term "color photocopier" to mean a "color printer." The district court noted that the Sweda catalogue expressly advertises: "A color picture of your customers custom logo produced by our new advanced computer laser printer." Based on this, the district court determined that the Sweda catalogue inherently disclosed a color printer because "those in the graphic arts industry would have recognized that a color printing device is necessarily present in the catalogue's description of 'a full color rendering' produced from a 'computer laser printer.'" Nevertheless, a color printer is not a color photocopier.

The '717 patent specification teaches that a "major component" of the invention [\*1296] "is a printer, [\*\*8] preferably a color photocopier." Col. 3, ll. 62-64. At the same time, the patent also recognizes that a color

295 F.3d 1292, \*; 2002 U.S. App. LEXIS 13190, \*\*;  
63 U.S.P.Q.2D (BNA) 1597

photocopier does more than print in color -- it copies. Specifically, the specification teaches "photocopying with a color photocopier, such as of the types earlier described." Col. 6, ll. 20-21. The undisputed trial testimony of Dr. Steven J. Bares underscores this point: "Digital color copiers comprise a digital color scanner and a digital color laser printer which are directly connected together so that graphics transformed into digital information through the scanner are transmitted to the digital color laser printer for printing." As a matter of correct claim construction, therefore, a "color photocopier" requires the ability both to print and photocopy subject matter with color.

The difference between a printer and a photocopier may be minimal and obvious to those of skill in this art. Nevertheless, [HN4] obviousness is not inherent anticipation. *Jones v. Hardy*, 727 F.2d 1524, 1529, 220 U.S.P.Q. (BNA) 1021, 1025 (Fed. Cir. 1984) ("though anticipation is the epitome of obviousness, [they] are separate and distinct concepts"). Given the strict identity required of the [\*\*9] test for novelty, on this record no reasonable jury could conclude that the Sweda catalogue discloses either expressly or inherently a color photocopier. Because claim 3 is not inherently anticipated, dependent claims 4 and 5 also are not anticipated.

Claim 8 recites, in relevant part:

8. A method of producing an instrument face having functional indicia thereon, utilizing a computer and printer, comprising the steps of:

(a) creating the instrument face with functional indicia thereon in the computer in electronic format . . . .

Col. 8, ll. 1-5 (emphases added). While claim 3 has the broader language "creating or providing," claim 8 recites only "creating." Nonetheless, the district court interpreted both claims to require "creating or providing in a computer a multicolor logo and hour markings to comprise the face of an instrument." (Emphasis added.) The district court found that the Sweda catalogue inherently anticipated "creating or providing" as required by its claim construction. Because claim 8 requires "creating" rather than "creating or providing," the district court erred in its construction of that claim and in its corresponding determination [\*\*10] of inherent anticipation.

The '717 patent does not define expressly "creating" or "providing." The two terms, however, have distinct meanings. Each term appears in claim language. Each therefore imparts a different scope to the claim in which

it appears. See, e.g., *Unique Concepts, Inc. v. Brown*, 939 F.2d 1558, 1562, 19 U.S.P.Q.2D (BNA) 1500, 1503 (Fed. Cir. 1991) ("The fact that mitered linear border pieces meet to form a right angle corner does not make them right angle corner pieces, when the claim separately recites both linear border pieces and right angle corner border pieces.").

In its teachings, the specification treats the two terms differently. For example, with respect to preparing an instrument face for printing, the specification describes a two step process: "The artwork . . . is created in electronic format in the computer. Information may initially be inputted into the computer for this purpose from a conventional scanner or a CD ROM." Col. 4, ll. 7-11 (emphasis added). In sum, the patent recognizes that information may be provided (input) into the computer after creation elsewhere or, alternatively, may be created in the computer from scratch. Regarding [\*\*11] the creating step, the specification further teaches that "commercially available software programs" may be used to "produce almost [\*1297] any design desired on an instrument face." Col. 4, ll. 11-14, 18. In view of these teachings, this court construes "creating" to require more than simply using the computer as a conduit to convey information to the printer from a scanner or a CD ROM. Creating requires, rather, a substantive addition or modification of the artwork in the computer, such as when graphics software adds a design to an instrument face.

The Sweda catalogue discloses, as discussed above, various printing methods. These printing methods disclose nothing about creating artwork in a computer. For this reason, the Sweda catalogue does not inherently anticipate claim 8. Specifically, the Sweda catalogue may well have created instrument faces with conventional manual methods. Then after manual creation or assembly, the Sweda catalogue may have provided those faces to a computer only for printing. Indeed, the Sweda catalogue required expressly that its customers provide color separations of their artwork. The record suggests that those of skill in this art use color separations to create [\*\*12] manually a composite color rendering of the desired image. Then a black and white laser printer makes separate transparent color sheets based on the color separations. Finally, the artisans overlay the separate color sheets manually to form a composite color rendering of the desired image. This process requires no substantive addition or modification of the artwork in the computer -- as mandated by a correct reading of the term "create." In other words, the process suggested by the Sweda catalogue combines the color sheets outside of the computer, with the computer serving merely as a conduit for printing. It is irrelevant that a skilled artisan might possibly use the computer to

295 F.3d 1292, \*; 2002 U.S. App. LEXIS 13190, \*\*;  
63 U.S.P.Q.2D (BNA) 1597

create the final desired image from the color separations. Inherency does not embrace probabilities or possibilities. *In re Robertson*, 169 F.3d 743, 745, 49 U.S.P.Q.2D (BNA) 1949, 1951 (Fed. Cir. 1999). In sum, no reasonable jury could find that the Sweda catalogue anticipates either expressly or inherently this claim.

Cases involving novelty, with its strict identity requirement, are quite rare. Obviousness seems the actual issue here. This court, however, cannot reach that question without a fully [\*\*13] developed record. [HN5] Obviousness involves, for instance, questions of suggestion to combine, see, e.g., *In re Rouffet*, 149 F.3d 1350, 47 U.S.P.Q.2D (BNA) 1453 (Fed. Cir. 1998), and objective indicators of patentability, see, e.g., *Graham v. John Deere Co.*, 383 U.S. 1, 17-18, 15 L. Ed. 2d 545, 86 S. Ct. 684 (1966). On appeal, this court cannot venture into these factual and complex areas without a developed

record. Accordingly, this record requires remand to permit the trial court to apply the obviousness standards in light of the Sweda catalogue and other prior art as viewed with the knowledge of one of skill in the art at the time of invention.

#### CONCLUSION

Because the district court erred in granting summary judgment that claims 3-5, 8, 12, and 13 are inherently anticipated, this court vacates and remands for a determination on the issue of obviousness and other proceedings consistent with this opinion.

#### COSTS

Each party shall bear its own costs.

#### VACATED AND REMANDED

**EXHIBIT F**

LEXSEE 64 USPQ 2D 1676

**ROSCO, INC., Plaintiff-Appellant, v. MIRROR LITE COMPANY, Defendant-Cross Appellant.**

**01-1271, 01-1302**

**UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT**

**304 F.3d 1373; 2002 U.S. App. LEXIS 20206; 64 U.S.P.Q.2D (BNA) 1676**

**September 24, 2002, Decided**

**SUBSEQUENT HISTORY:** [\*\*1] Rehearing and Rehearing En Banc Denied December 5, 2002, Reported at: 2002 U.S. App. LEXIS 27299. Rehearing denied by, Rehearing, en banc, denied by *Rosco, Inc. v. Mirror Lite Co.*, 2002 U.S. App. LEXIS 27299 (Fed. Cir., Dec. 5, 2002)

On remand at, Findings of fact/conclusions of law at *Rosco, Inc. v. Mirror Lite Co.*, 2003 U.S. Dist. LEXIS 26209 (E.D.N.Y., July 8, 2003)

**PRIOR HISTORY:**Appealed from: United States District Court for the Eastern District of New York. Senior Judge Charles P. Sifton. *Rosco, Inc. v. Mirror Lite Co.*, 139 F. Supp. 2d 287, 2001 U.S. Dist. LEXIS 871 (E.D.N.Y., 2001)

**DISPOSITION:** AFFIRMED-IN-PART, REVERSED-IN-PART, VACATED-IN-PART, and REMANDED.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Appellant manufacturer sued appellee/cross-appellant company for patent infringement, tortious interference with business relations, misrepresentation, and common law trademark infringement. The United States District Court for the Eastern District of New York ruled for the company on all claims. The manufacturer appealed.

**OVERVIEW:** The manufacturer claimed that the company infringed on the manufacturer's convex cross-view mirror with a black, flat metal backing for school buses. The appellate court held that the mere fact that the manufacturer's mirror claimed in the design patent exhibited a superior field of view over a single

predecessor mirror did not establish that the design was dictated by functional considerations. Other mirrors that had non-oval shapes also offered that particular field of view. Nothing in the record connected the oval shape of the patented design with aerodynamics. Further, other non-oval shaped mirrors had the same aerodynamic effect. The company had not shown by clear and convincing evidence that there were no designs, other than the one shown in the manufacturer's patent, that had the same functional capabilities as the manufacturer's oval mirror. Under these circumstances, it could not have been said that the claimed design of the mirror patent was dictated by functional considerations. Finally, there was no evidence that one skilled in the art would read the patent as inherently disclosing a mirror with varying radius of curvature along the major axis.

**OUTCOME:** The appellate court reversed the district court's: (1) ruling that the mirror patent claim was invalid on functionality grounds; (2) finding of invalidity of the utility patent; finding that the utility patent was invalid under anticipation; finding that the utility patent was unenforceable for inequitable conduct. The appellate court remanded the tortious interference claim, and affirmed the denial of the misrepresentation and trademark claims.

**LexisNexis(R) Headnotes**

***Civil Procedure > Trials > Bench Trials***

[HN1] *Fed. R Civ. P. 52(a)* requires that in all actions tried upon the facts without a jury or with an advisory jury, the court shall find the facts specially and state separately its conclusions of law thereon. *Fed. R. Civ. P. 52(a)*. A trial court must provide sufficient factual

304 F.3d 1373, \*; 2002 U.S. App. LEXIS 20206, \*\*;  
64 U.S.P.Q.2D (BNA) 1676

findings such an appellate court may meaningfully review the merits of its order.

**Evidence > Procedural Considerations > Inferences & Presumptions**

**Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > General Overview**

**Patent Law > Infringement Actions > Defenses > Patent Invalidity > Validity Presumption**

[HN2] A patent shall be presumed valid. 35 U.S.C.S. § 282. To overcome this presumption of validity, the party challenging a patent must prove facts supporting a determination of invalidity by clear and convincing evidence.

**Patent Law > Subject Matter > Designs > Ornamentality Requirement**

**Patent Law > Subject Matter > Designs > Functionality**

**Patent Law > Inequitable Conduct > Burdens of Proof**

[HN3] Courts apply a stringent standard for invalidating a design patent on grounds of functionality: the design of a useful article is deemed functional where the appearance of the claimed design is dictated by the use or purpose of the article. The design must not be governed solely by function, i.e., that this is not the only possible form of the article that could perform its function. When there are several ways to achieve the function of an article of manufacture, the design of the article is more likely to serve a primarily ornamental purpose. That is, if other designs could produce the same or similar functional capabilities, the design of the article in question is likely ornamental, not functional. Invalidity of a design patent claim must be established by clear and convincing evidence.

**Patent Law > Nonobviousness > Elements & Tests > Prior Art**

**Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > General Overview**

**Patent Law > Nonobviousness > Evidence & Procedure > Presumptions & Proof**

[HN4] In a patent case, a finding of obviousness cannot be made without determining whether the invalidating prior art shows or renders obvious the ornamental features of the claimed design.

**Patent Law > Nonobviousness > Elements & Tests > Prior Art**

**Patent Law > Nonobviousness > Elements & Tests > Ordinary Skill Standard**

**Patent Law > Claims & Specifications > Enablement Requirement > General Overview**

[HN5] In a patent case, the obviousness of a design is determined by ascertaining whether the applicable prior art contains any suggestion or motivation for making the

modifications in the design of the prior art article in order to produce the claimed design. The inquiry under 35 U.S.C.S. § 103 is whether the claimed design would have been obvious to a designer of ordinary skill who designs articles of the type involved.

**Patent Law > Anticipation & Novelty > Accidental Anticipation & Inherency**

**Patent Law > Anticipation & Novelty > Elements**

**Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > General Overview**

[HN6] In a patent case, under the doctrine of inherency, if an element is not expressly disclosed in a prior art reference, the reference will still be deemed to anticipate a subsequent claim if the missing element is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherent anticipation requires that the missing descriptive material is necessarily present, not merely probably or possibly present, in the prior art.

**Patent Law > Date of Invention & Priority > Abandonment, Concealment & Resumption of Activity**

**Patent Law > Anticipation & Novelty > Invention**

**Patent Law > Infringement Actions > Defenses > Patent Invalidity > General Overview**

[HN7] A patent is invalid under 35 U.S.C.S. § 102(g)(2) if, before the applicant's invention thereof, the invention was made in the United States by another who had not abandoned, suppressed, or concealed it. 35 U.S.C.S. § 102(g)(2). Prior invention by another invalidates a claimed invention under § 102(g)(2) if the prior inventor either reduced the invention to practice first, or conceived of the invention first and subsequently reduced the invention to practice. However, conception and reduction to practice cannot be established nunc pro tunc. There must be contemporaneous recognition and appreciation of the invention. There is no conception or reduction to practice where there has been no recognition or appreciation of the existence of the invention.

**Patent Law > Date of Invention & Priority > General Overview**

**Patent Law > Infringement Actions > Burdens of Proof**

**Patent Law > Infringement Actions > Defenses > Patent Invalidity > General Overview**

[HN8] In a patent case, a party claiming his own prior inventorship must proffer evidence corroborating his testimony.

**Trademark Law > Federal Unfair Competition Law > False Advertising > General Overview**

**Trademark Law > Federal Unfair Competition Law > False Designation of Origin > Elements**

304 F.3d 1373, \*; 2002 U.S. App. LEXIS 20206, \*\*;  
64 U.S.P.Q.2D (BNA) 1676

**Trademark Law > Federal Unfair Competition Law > Trade Dress Protection > General Overview**

[HN9] To establish misrepresentation under 15 U.S.C.S. § 1125(a), a plaintiff must show that the statement at issue is either: (1) literally false as a factual matter; or (2) although literally true, it is likely to deceive or confuse customers. The plaintiff must also prove that the defendant misrepresented an inherent quality or characteristic of the product.

**Trademark Law > Infringement Actions > General Overview**

**Trademark Law > Federal Unfair Competition Law > False Advertising > General Overview**

**Trademark Law > Federal Unfair Competition Law > Trade Dress Protection > General Overview**

[HN10] 15 U.S.C.S. § 1125(a) protects unregistered marks.

**Trademark Law > Infringement Actions > Burdens of Proof**

**Trademark Law > Federal Unfair Competition Law > Trade Dress Protection > Causes of Actions**

**Trademark Law > Federal Unfair Competition Law > False Designation of Origin > Elements**

[HN11] Unregistered marks receive essentially the same protection as registered marks. Courts interpret § 43(a) of the Lanham Act, 35 U.S.C.S. § 1125(a) as having created a federal cause of action for infringement of unregistered trademark or trade dress and concludes that such a mark or trade dress should receive essentially the same protection as those that are registered. When § 43(a) of the Act is used as a federal vehicle for assertion of traditional claims of infringement of trademarks, the courts uses as substantive law the traditional rules of trademarks and unfair competition law. The test of liability is likelihood of confusion. Under § 43(a), the ultimate test is whether the public is likely to be deceived or confused by the similarity of the marks. Whether it is called the violation infringement, unfair competition, or false designation of origin, the test is identical—is there a likelihood of confusion? To prevail on a claim for common law trademark infringement under 35 U.S.C.S. § 1125(a), a party must show likelihood of confusion. This is required by the statute itself: § 1125(a) is triggered by a use that is likely to cause confusion, or to cause mistake, or to deceive as to the affiliation, connection, or association" of the user with the senior user.

**COUNSEL:** Alfred R. Fabricant, Ostrolenk, Faber, Gerb & Soffen, LLP, of New York, New York, argued for plaintiff-appellant. With him the brief was Max Moskowitz.

John A. Artz, Artz & Artz, P.C., of Southfield, Minnesota, argued for defendant-cross appellant. With him on the brief were John S. Artz and Robert P. Renke.

**JUDGES:** Before LOURIE, Circuit Judge, PLAGER, Senior Circuit Judge, and DYK, Circuit Judge.

**OPINIONBY:** DYK

**OPINION:** [\*1376]

DYK, Circuit Judge.

Rosco, Inc. ("Rosco") appeals the decision of the United States District Court for the Eastern District of New York finding Rosco's design patent, United States Design Patent No. 346,357 ("the '357 patent"), invalid as functional and obvious, finding that Rosco abandoned its claim that Mirror Lite Company ("Mirror Lite") inequitably procured its utility patent, United States Patent No. 5,589,984 ("the '984 patent"), and rejecting Rosco's claims under 15 U.S.C. § 1125(a) of tortious interference with business relations, misrepresentation, [\*\*2] and common law trademark infringement. *Rosco, Inc. v. Mirror Lite Co.*, 139 F. Supp. 2d 287 (E.D.N.Y. 2001). Mirror Lite cross-appeals the district court's decision that the claims of the '984 patent are invalid. Because the district court erred in finding the '357 patent invalid as functional and obvious; finding the claims of the '984 patent invalid under 35 U.S.C. §§ 102(e) and 102(g); and finding that Rosco abandoned its inequitable conduct claims, we reverse in part, vacate in part, and remand. On remand, the district court should make findings and conclusions on all relevant issues as required by *Federal Rule of Civil Procedure 52*. Fed. R. Civ. P. 52. We affirm the district court's rejection of Rosco's claims under 15 U.S.C. § 1125(a) of misrepresentation and common law trademark infringement.

**BACKGROUND**

Rosco and Mirror Lite are competitors in the school bus mirror market. This dispute involves "cross-view" mirrors, which are convex, three-dimensional, curved surface mirrors mounted on the front fender of a school bus, enabling the bus driver to view the front and passenger side of a school bus. Rosco filed a complaint [\*\*3] on November 19, 1996, and amended the complaint on December 27, 1996 (the "Rosco I case"). A second civil action was subsequently filed by Rosco in October 1999 (the "Rosco II case"). Mirror Lite asserted a counterclaim in the second action. The two cases were consolidated.

304 F.3d 1373, \*; 2002 U.S. App. LEXIS 20206, \*\*;  
64 U.S.P.Q.2D (BNA) 1676

Each party owns a patent that it alleged was infringed by the other. Rosco raised a variety of other claims.

### 1. Rosco's '357 Design Patent

Rosco's '357 design patent relates to an oval, highly convex cross-view mirror with a black, flat metal backing. Rosco applied for the patent on April 14, 1992, and the patent issued on April 26, 1994. Rosco alleged that Mirror Lite infringed the '357 design patent. Mirror Lite argued that the '357 design patent was invalid as functional and therefore was not infringed.

### 2. Mirror Lite's '984 Utility Patent

Mirror Lite's '984 utility patent relates to an oval cross-view mirror with a varying radius of curvature along the major axis of the convex ellipsoid mirror lens. Mirror Lite filed the parent application that led to the '984 patent on September 9, 1992. The '948 patent issued on December 31, 1996. Rosco requested declaratory judgment that all claims of the '984 patent [\*\*4] were invalid as anticipated under 35 U.S.C. § 102(a), invalid for failure to name the true inventor under 35 U.S.C. § 102(f), invalid as previously invented by another under 35 U.S.C. § 102(g), and unenforceable due to Mirror Lite's inequitable conduct in procuring the patent. n1 Mirror Lite counterclaimed that Rosco infringed the '984 patent.

n1 The district court deemed Rosco's complaint amended to add claims of patent invalidity under 35 U.S.C. § 102(e) (inherently anticipated by prior art) and 35 U.S.C. § 103 (invalid as obvious). *Rosco*, 139 F. Supp. 2d at 300.

### [\*1377] 3. Rosco's Other Claims

Rosco also alleged that Mirror Lite: engaged in tortious interference with business relations by procuring the '984 patent through inequitable conduct; engaged in misrepresentation by publishing disparaging statements about Rosco's mirrors; and engaged in common law trademark infringement by using [\*\*5] the marks "Eagle Eye" and "Mini Eagle Eye" to compete with Rosco's "Hawk Eye" and "Mini Hawk Eye" products.

In the Rosco I case, Mirror Lite moved for summary judgment on all claims, and the district court granted summary judgment as to Rosco's claim of tortious interference with business relations. *Rosco*, 139 F. Supp. 2d at 294-95. The court denied Rosco's motion for reconsideration on August 19, 1999. Id. However, the court later effectively granted reconsideration and

reinstated the claim of tortious interference with business relations. *Id. at 304 n.14.*

After a bench trial, the district court: found the '357 design patent invalid as functional and obvious under 35 U.S.C. § 103; found the claims of the '984 patent invalid under 35 U.S.C. §§ 102(e) and 102(g); did not reach Rosco's claim for design patent infringement because it found the '357 patent invalid; did not reach Mirror Lite's claim of patent infringement because it found the '984 patent claims invalid; did not address the validity of the '984 patent under 35 U.S.C. §§ 102(a), 102(f), and 103; found that Rosco abandoned [\*\*6] its inequitable conduct claims; and rejected Rosco's claims of misrepresentation and common law trademark infringement.

The parties timely appealed. We have jurisdiction under 28 U.S.C. § 1295(a)(1).

### DISCUSSION

This case presents an example of the need for clear findings of fact and conclusions of law. [HN1] *Federal Rule of Civil Procedure 52(a)* requires that "in all actions tried upon the facts without a jury or with an advisory jury, the court shall find the facts specially and state separately its conclusions of law thereon." *Fed. R. Civ. P. 52(a)*. We have noted the importance of compliance with these requirements, recognizing that one of the purposes of Rule 52(a) is to "provide the appellate court with an adequate basis for review." *Gechter v. Davidson*, 116 F.3d 1454, 1458, 43 U.S.P.Q.2D (BNA) 1030, 1033 (Fed. Cir. 1997); see also *Pretty Punch Shopettes, Inc. v. Hauk*, 844 F.2d 782, 784, 6 U.S.P.Q.2D (BNA) 1563, 1565 (Fed. Cir. 1988) ("The trial court must provide sufficient factual findings such that we may meaningfully review the merits of its order."). Here, the district court failed in several instances to make sufficient findings of fact [\*\*7] and conclusions of law to provide the necessary predicate for judicial review.

We note also that the parties in this case have made prolix, confusing, and contentious arguments, which no doubt made it particularly difficult for the district court to address the issues with clarity and precision. We trust that, on remand, counsel will provide the necessary assistance to the district court by appropriately narrowing the issues and coherently explaining their respective positions.

### I Rosco's '357 Design Patent

[HN2] "A patent shall be presumed valid." 35 U.S.C. § 282 (2000). To overcome this presumption of validity, the party challenging a patent must prove facts supporting a determination of invalidity by clear and convincing evidence. *Apotex USA, Inc. v. Merck & Co.*, 254 F.3d 1031, 1036, 59 U.S.P.Q.2D (BNA) 1139, 1142-

304 F.3d 1373, \*; 2002 U.S. App. LEXIS 20206, \*\*;  
64 U.S.P.Q.2D (BNA) 1676

43 (*Fed. Cir. 2001*), cert. denied, 534 U.S. 1172, 152 L. Ed. 2d 136, [\*1378] 122 S. Ct. 1196 (2002) (citing *Am. Hoist & Derrick Co. v. Sowa & Sons, Inc.*, 725 F.2d 1350, 1360, 220 U.S.P.Q. (BNA) 763, 770 (*Fed. Cir. 1984*)).

Rosco's '357 design patent shows a highly convex, curved-surface, three-dimensional oval mirror with a black, flat metal [\*\*8] backing. In May 1992, Rosco began manufacturing the mirror of the '357 patent under the name "Eagle Eye."

Rosco alleged that Mirror Lite infringed the '357 patent by manufacturing and selling a duplicate of Rosco's mirror under the name "Hawk Eye." Mirror Lite argued that the '357 patent was invalid as functional. The district court found the '357 design patent invalid as functional. *Rosco*, 139 F. Supp. 2d at 296.

[HN3] We apply a stringent standard for invalidating a design patent on grounds of functionality: the design of a useful article is deemed functional where "the appearance of the claimed design is 'dictated by' the use or purpose of the article." *L.A. Gear, Inc. v. Thom McAn Shoe Co.*, 988 F.2d 1117, 1123, 25 U.S.P.Q.2D (BNA) 1913, 1917 (*Fed. Cir. 1993*) (citing *In re Carletti*, 51 C.C.P.A. 1094, 328 F.2d 1020, 1022, 140 U.S.P.Q. (BNA) 653, 654 (CCPA 1964)). "The design must not be governed solely by function, i.e., that this is not the only possible form of the article that could perform its function." *Seiko Epson Corp. v. Nu-Kote Int'l, Inc.*, 190 F.3d 1360, 1368, 52 U.S.P.Q.2D (BNA) 1011, 1017 (*Fed. Cir. 1999*). "When there are several [\*\*9] ways to achieve the function of an article of manufacture, the design of the article is more likely to serve a primarily ornamental purpose." *L.A. Gear*, 988 F.2d at 1123, 25 U.S.P.Q.2D at 1917 (citations omitted). That is, if other designs could produce the same or similar functional capabilities, the design of the article in question is likely ornamental, not functional. Invalidity of a design patent claim must be established by clear and convincing evidence. *Id.*

The district court found that because the mirror's oval shape, the asserted point of novelty of the '357 patent, "of necessity dictates its function," the '357 patent was invalid as functional. n2 *Rosco*, 139 F. Supp. 2d at 296. The court based its determination of functionality on its findings that the mirror of the '357 patent offered a unique field of view (when compared to Mirror Lite's Bus Boy mirror); that Rosco represented to the Patent and Trademark Office that its mirror provided a superb field of view; and that Rosco marketed the mirror of the '357 patent as more "aerodynamic" than other cross-view mirrors. *Id.*

n2 The district court's finding in this respect appears to be inconsistent with its earlier summary judgment decision, in which it noted: "A review of the other cross-over mirrors on the market reveals that several different styles of cross-over mirrors exist . . . . It cannot be said that the oval shape and flat backing are dictated by function." *Rosco, Inc. v. Mirror Lite Co.*, No. CV-96-5658, at 15 (E.D.N.Y. June 2, 1999) (order granting summary judgment in part).

-----End Footnotes-----

[\*\*10]

The mere fact that the invention claimed in the design patent exhibited a superior field of view over a single predecessor mirror (here, the Bus Boy) does not establish that the design was "dictated by" functional considerations, as required by *L.A. Gear*. The record indeed reflects that other mirrors that have non-oval shapes also offer that particular field of view. Similarly, nothing in the record connects the oval shape of the patented design with aerodynamics, and the record shows that other non-oval shaped mirrors have the same aerodynamic effect.

Mirror Lite has not shown by clear and convincing evidence that there are no designs, other than the one shown in Rosco's [\*1379] '357 patent, that have the same functional capabilities as Rosco's oval mirror. Under these circumstances it cannot be said that the claimed design of the '357 patent was dictated by functional considerations. We reverse the district court and hold that the '357 patent claim was not shown to be invalid on functionality grounds.

The district court in a footnote further found the '357 patent claim invalid as obvious, stating simply that "the '357 Patent is invalid as obvious." *Rosco*, 139 F. Supp. 2d at 296 n.5. [\*\*11] No findings to support this holding of obviousness were made. [HN4] A finding of obviousness cannot be made without determining whether the invalidating prior art shows or renders obvious the ornamental features of the claimed design. *OddzOn Prods., Inc. v. Just Toys, Inc.*, 122 F.3d 1396, 1404, 43 U.S.P.Q.2D (BNA) 1641, 1646 (*Fed. Cir. 1997*). n3 Because the district court failed to make the necessary findings as to obviousness, we remand for compliance with Rule 52. Should the district court find the '357 patent not invalid, the issue of whether that patent was infringed would have to be addressed by the district court.

n3 See *In re Haruna*, 249 F.3d 1327, 1335, 58 U.S.P.Q.2D (BNA) 1517, 1522 (*Fed. Cir.*

304 F.3d 1373, \*; 2002 U.S. App. LEXIS 20206, \*\*;  
64 U.S.P.Q.2D (BNA) 1676

2001) [HN5] ("The obviousness of a design 'is determined by ascertaining whether the applicable prior art contains any suggestion or motivation for making the modifications in the design of the prior art article in order to produce the claimed design.'") (quoting *Hupp v. Siroflex of Am., Inc.*, 122 F.3d 1456, 1462, 43 U.S.P.Q.2D (BNA) 1887, 1891 (Fed. Cir. 1997)); *Durling v. Spectrum Furniture Co.*, 101 F.3d 100, 103, 40 U.S.P.Q.2D (BNA) 1788, 1790 (Fed. Cir. 1996) (The inquiry under section 103 is "whether the claimed design would have been obvious to a designer of ordinary skill who designs articles of the type involved.").

[\*\*12]

## II Mirror Lite's '984 Utility Patent

Mirror Lite's '984 patent claims an oval cross-view mirror with a varying radius of curvature along the major axis of the lens. Rosco sought a declaratory judgment that the '984 patent claims were invalid under 35 U.S.C. §§ 102 and 103, and that the '984 patent was unenforceable on grounds of inequitable conduct.

The district court found claims 1-3 and 6-8 of the '984 patent invalid under both 35 U.S.C. § 102(e) (invalidating claims based on anticipation by an earlier filed United States application) and 35 U.S.C. § 102(g) (invalidating claims based on prior invention "by another"). *Rosco*, 139 F. Supp. 2d at 302-03. Independent claim 1 provides:

A mirror assembly, comprising:

(a) a mirror lens having a reflective outer surface and a non-reflective rear surface, the mirror lens comprising a mirror body which terminates in an oval perimetral edge, the edge surrounds the reflective surface and the non-reflective surface of the mirror lens, the mirror body being a substantially convex ellipsoid having a major axis and a minor axis which intersects with [\*\*13] the major axis, the major axis having a varying radius of curvature, which radius decreases from the

intersection with the minor axis to the perimetral edge.

'984 patent, col. 4, ll. 21-31 (emphasis added). Claim 1 thus requires a "varying radius of curvature" along the major axis of the lens. Rosco argued that if the prior art disclosed the varying radius of curvature, then claim 1 is invalid. It made the same argument with respect to dependent claims 2-3 and 6-8. The district court agreed. *Rosco*, 139 F. Supp. 2d at 302.

When determining the validity of the claims of a patent, each claim must be separately considered:

[\*1380] Each claim of a patent (whether in independent, dependent, or multiple dependent form) shall be presumed valid independently of the validity of other claims; dependent or multiple dependent claims shall be presumed valid even though dependent upon an invalid claim. . . The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting invalidity.

35 U.S.C. § 282 (2000) (emphasis added). Here, the district court found claims 1-3 and 6-8 of the '984 patent [\*\*14] invalid without explicitly addressing and analyzing each claim, apparently addressing only independent claim 1. n4 There is no evidence that Mirror Lite conceded that those claims stand or fall with independent claim 1. The district court erred by not separately addressing each claim, and on remand should do so. Because we find that the district court's grounds for finding invalidity are not substantiated, we need not consider the claims individually here.

n4 Also, the district court failed to explicitly mention claims 4, 5, and 9, instead concluding: "the '984 patent is declared invalid." *Rosco*, 139 F. Supp. 2d at 303. On remand, the district court should consider these claims.

The district court found that the '357 patent inherently disclosed the invention of the '984 patent under 35 U.S.C. § 102(e), such that one skilled in the art would read the '357 patent as disclosing a mirror with varying radius of curvature: "the '357 Patent shows a mirror with a varying radius [\*\*15] of curvature based on the inherent nature of such a characteristic." *Rosco*, 139 F. Supp. 2d at 301. The district court concluded that

304 F.3d 1373, \*; 2002 U.S. App. LEXIS 20206, \*\*;  
64 U.S.P.Q.2D (BNA) 1676

"one skilled in the art could produce the results claimed in the '984 Patent simply by practicing the '357 Patent, i.e., the result flows naturally from the express disclosures of the '357 Patent whether or not others are aware of it." *Id.* at 300. In reaching this conclusion, the district court relied on Benjamin Englander's n5 testimony that "Rosco would have preferred to have a mirror that had a constant radius of curvature, . . . [but] the vacuum thermoforming process used to manufacture such mirrors of necessity yields a mirror with a varying radius of curvature." *Id.* at 301-02. Noting that "this evidence was not contradicted at trial," the court concluded that "anyone practicing the '357 patent by attempting to manufacture it would, on the uncontradicted evidence at trial, come up with a mirror with a varying radius of curvature." *Id.* at 301.

n5 Rosco is a closely held corporation owned by the Englander family: Solomon Englander, Rosco's president (father); Benjamin Englander, Rosco's vice president of engineering (son); Daniel Englander, Rosco's vice president of finance (son); and Gertrude Englander (mother).

[\*\*16]

We disagree. [HN6] Under the doctrine of inherency, if an element is not expressly disclosed in a prior art reference, the reference will still be deemed to anticipate a subsequent claim if the missing element "is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Cont'l Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 U.S.P.Q.2D (BNA) 1746, 1749 (Fed. Cir. 1991). "Inherent anticipation requires that the missing descriptive material is 'necessarily present,' not merely probably or possibly present, in the prior art." *Trintec Indus., Inc. v. Top-U.S.A. Corp.*, 295 F.3d 1292, 1295, 63 U.S.P.Q.2D (BNA) 1597, 1599 (Fed. Cir. 2002) (quoting *In re Robertson*, 169 F.3d 743, 745, 49 U.S.P.Q.2D (BNA) 1949, 1950-51 (Fed. Cir. 1999)). The vacuum thermoforming process, however, is not specified in the '357 patent. [\*1381] Thus, the question is not whether the manufacture of the mirror using this process inherently results in a varying radius of curvature along the major axis, but whether one skilled in the art would read the '357 patent as inherently disclosing the invention of the '984 patent, that is, whether one [\*\*17] skilled in the art would read the '357 patent as showing a mirror of varying radius of curvature along the major axis. There is no evidence in the record to support a finding that one skilled in the art would so read the '357 patent. Englander's testimony only purports to establish that mirrors manufactured using the vacuum thermoforming process yield a varying radius of

curvature along the major axis, but does not purport to establish that the mirror of the '357 patent can only be manufactured by that particular process. At oral argument, counsel for Rosco could not identify any evidence that one skilled in the art would read the '357 patent as inherently disclosing a mirror with varying radius of curvature along the major axis. We accordingly reverse the district court's conclusion that the '984 patent is invalid under section 102(e).

The district court also found claims 1-3 and 6-8 of the '984 patent invalid under section 102(g) in view of Rosco's pre-1992 products, finding that Rosco made the invention of the '984 patent before the '984 critical date. [HN7] A patent is invalid under section 102(g)(2) if "before the applicant's invention thereof the invention was made in this country [\*\*18] by another who had not abandoned, suppressed, or concealed it." 35 U.S.C. § 102(g)(2) (2000); *Dow Chem. Co. v. Astro-Valcour, Inc.*, 267 F.3d 1334, 1339, 60 U.S.P.Q.2D (BNA) 1519, 1522 (Fed. Cir. 2001). Prior invention by another invalidates a claimed invention under section 102(g)(2) if the prior inventor either reduced the invention to practice first, or conceived of the invention first and subsequently reduced the invention to practice. However, "it is well-settled that conception and reduction to practice cannot be established *nunc pro tunc*. There must be contemporaneous recognition and appreciation of the invention . . ." *Estee Lauder Inc. v. L'Oreal, S.A.*, 129 F.3d 588, 593, 44 U.S.P.Q.2D (BNA) 1610, 1614 (emphasis in original) (citing *Breen v. Henshaw*, 472 F.2d 1398, 1401, 176 U.S.P.Q. (BNA) 519, 521 (CCPA 1973); see also *Dow Chem. Co. v. Astro-Valcour, Inc.*, 267 F.3d 1334, 1341, 60 U.S.P.Q.2D (BNA) 1519, 1523 (Fed. Cir. 2001) ("There is no conception or reduction to practice where there has been no recognition or appreciation of the existence of the [invention]."). The question is whether Rosco actually recognized and [\*\*19] appreciated a mirror with varying radius of curvature along the major axis of the lens. Though the issue is disputed, particularly with regard to trial exhibit 110, we may assume for present purposes that the earlier Rosco product did in fact have a varying radius of curvature along the major axis of the lens. But there is no evidence that this feature of the invention was recognized and appreciated.

At oral argument we requested Rosco's counsel to identify any evidence that, at the time of invention, Rosco recognized that the mirror it designed had a varying radius of curvature along the major axis, even though Rosco intended to design a mirror with constant curvature along the major axis that would not distort the images in the mirror lens. Counsel pointed to the testimony of Englander, who was asked: "When you came up with the idea of this oval mirror, did you have

304 F.3d 1373, \*; 2002 U.S. App. LEXIS 20206, \*\*;  
64 U.S.P.Q.2D (BNA) 1676

any part of your idea, did it relate to this concept of varying curvature?" Englander answered: "The varying curvature, in my mind, it was automatic because this is the process of producing these lenses which has to have, by nature, a various curvature." [\*1382] Englander's testimony is self-interested and lacks corroboration. [\*\*20] It is well established that [HN8] a party claiming his own prior inventorship must proffer evidence corroborating his testimony. *Sandt Techs. Ltd. v. Resco Metal & Plastics Corp.*, 264 F.3d 1344, 1350, 60 U.S.P.Q.2D (BNA) 1091, 1094 (Fed. Cir. 2001). Englander's testimony is insufficient to constitute clear and convincing evidence that Rosco conceived the invention of the '984 patent before the '984 critical date. We therefore reverse the district court's conclusion that the '984 patent is invalid under section 102(g).

The district court did not decide whether the '984 patent was invalid under sections 102(a), 102(f), or 103, stating that "since the '984 Patent is invalid under 35 U.S.C. § 102(e) and (g), there is no need to consider claims of its invalidity under 35 U.S.C. §§ 102(a), (f), or 103." *Rosco*, 139 F. Supp. 2d at 303 n.13. On remand, the district court should analyze the validity of each claim and should consider validity under sections 102(a), 102(f), and 103.

Finally, the district court rejected Rosco's claim that the '984 patent was unenforceable for inequitable conduct, stating that "Rosco is not entitled [\*\*21] to judgment that the '984 patent was inequitably procured." *Rosco, Inc. v. Mirror Lite Co.*, No. CV-96-5658 and CV-99-6211, at 2 (E.D.N.Y. Feb. 21, 2001) (final judgment). The district court made no findings or conclusions supporting this result, and did not expressly consider this claim. n6 Again we hold that a remand is required for necessary findings and conclusions as to each claim.

n6 We reject Mirror Lite's argument that the inequitable conduct issue was not properly raised.

If on remand the district court finds any of the '984 patent claims not invalid and not unenforceable, the issue of whether those claims were infringed would have to be addressed by the district court.

### III Rosco's Tortious Interference Claim

Rosco stated a claim under 15 U.S.C. § 1125(a) for tortious interference with business relationships based on Mirror Lite's alleged inequitable conduct in securing the '984 patent. [A11]. In a footnote, the district court rejected this claim on the ground that [\*\*22] it had been abandoned:

The Court informed counsel for both parties that the summary judgment opinion . . . did not dispose of Rosco's claim of tortious interference with business relations . . . and invited the parties to submit briefing on this issue. Rosco has not pursued this cause of action at all in either of its two post-trial briefs. Therefore, the Court must consider that Rosco has abandoned this cause of action.

*Rosco*, 139 F. Supp. 2d at 304 n.14. At oral argument Mirror Lite, with commendable candor, agreed that this claim had not been abandoned, because Rosco had in fact briefed the issue in its post-trial brief. We agree, and remand for findings and conclusions relating to this claim based on the record established at trial.

### IV Rosco's Misrepresentation Claim

The district court dismissed on summary judgment Rosco's claim that Mirror Lite engaged in unfair competition under 15 U.S.C. § 1125(a) by publishing disparaging statements about Rosco's oval mirror. *Rosco, Inc. v. Mirror Lite Co.*, No. CV-96-5658, at 30 (E.D.N.Y. June 2, 1999) (order granting summary judgment in part) and denied reconsideration. Rosco alleged [\*\*23] that Mirror Lite misrepresented Rosco's oval mirror to consumers by publishing [\*1383] various statements, such as that Rosco's mirror did not comply with federal safety standards and that school bus owners must replace their mirrors with mirrors of "identical appearance" to comply with federal safety standards. [HN9] To establish misrepresentation under 15 U.S.C. § 1125(a), a plaintiff must show that the statement at issue is either (1) literally false as a factual matter; or (2) although literally true, it is likely to deceive or confuse customers. *Nat'l Basketball Assoc. v. Motorola, Inc.*, 105 F.3d 841, 855, 41 U.S.P.Q.2D (BNA) 1585, 1597 (2d Cir. 1997). The plaintiff must also prove that the "defendant misrepresented an 'inherent quality or characteristic' of the product." *Nat'l Assoc. of Pharm. Mfrs. v. Ayerst Labs.*, 850 F.2d 904, 917, 7 U.S.P.Q.2D (BNA) 1530, 1540 (2d Cir. 1988) (citation omitted).

The district court dismissed Rosco's unfair competition claim after finding these statements "literally true," and that they were not "implicitly false" so as to cause confusion. *Rosco, Inc. v. Mirror Lite Co.*, No. CV-96-5658, at 27-28 (E.D.N.Y. June 2, 1999) [\*\*24] (order granting summary judgment in part). We affirm the district court. Rosco did not offer evidence of clear untruth or implied untruth sufficient to defeat summary judgment. We uphold the district court's grant of

304 F.3d 1373, \*; 2002 U.S. App. LEXIS 20206, \*\*;  
64 U.S.P.Q.2D (BNA) 1676

summary judgment as to this claim, because there is no genuine issue as to the truth of those statements.

#### V Rosco's Common Law Trademark Infringement Claim

The district court rejected Rosco's claim that Mirror Lite infringed its "Hawk Eye" and "Mini Hawk Eye" common law marks in violation of *15 U.S.C. § 1125(a)*: "Rosco has produced no evidence in the form of consumer surveys, advertising expenditure, or unsolicited media coverage that 'Hawk Eye' and 'Mini Hawk Eye' have attained secondary meaning. Nor has Rosco established a likelihood of confusion, given the sophistication of the purchasers in the school bus mirror market." n7 *Rosco, 139 F. Supp. 2d at 303-04.*

n7 While Rosco's "Hawk Eye" mark was apparently a registered trademark, Rosco asserted claims under [HN10] *15 U.S.C. § 1125(a)*, which protects unregistered marks. We therefore do not understand Rosco to have asserted a claim of trademark infringement.

[\*\*25]

Rosco asserted its claim under *15 U.S.C. § 1125(a)*, section 43(a) of the Lanham Act. [HN11] Unregistered marks receive essentially the same protection as registered marks: "The Court interprets this section [§ 43(a)] as having created a federal cause of action for infringement of unregistered trademark or trade dress and concludes that such a mark or trade dress should receive essentially the same protection as those that are registered." *Two Pesos, Inc. v. Taco Cabana, Inc., 505 U.S. 763, 776, 120 L. Ed. 2d 615, 112 S. Ct. 2753 (1992)* (Stevens, J., concurring). McCarthy notes: "When section 43(a) is used as a federal vehicle for assertion of traditional claims of infringement of trademarks, . . . the courts have used as substantive law the traditional rules of trademarks and unfair competition law," and concludes that "the test of liability is likelihood of confusion." 4 McCarthy on Trademarks and Unfair Competition § 27:18 at 27-32 (4th ed. 2002). See also *New West Corp. v. NYM Co. of Cal., 595 F.2d 1194, 1201, 202 U.S.P.Q. (BNA) 643, 649 (9th Cir. 1979)* ("Under [§ 43(a)] the ultimate test is whether the public is likely to be [\*\*26] deceived or confused by the similarity of the marks. . . . Whether we call the violation infringement, unfair competition or false designation of origin, the test is identical--is there a 'likelihood of confusion'?").

[\*1384] To prevail on a claim for common law trademark infringement under section 1125(a), a party must show likelihood of confusion. This is required by

the statute itself: section 1125(a) is triggered by a use that "is likely to cause confusion, or to cause mistake, or to deceive as to the affiliation, connection, or association" of the user with the senior user. *15 U.S.C. § 1125(a)* (2000). Rosco does not challenge the district court's finding that it failed to show likelihood of confusion.

Because Rosco did not show likelihood of confusion, we affirm the district court's denial of this claim. We need not address the district court's alternative ground for rejecting this claim, i.e., that Rosco failed to establish secondary meaning. n8

n8 Three other claims under *15 U.S.C. § 1125* were originally asserted in the district court: Rosco alleged that Mirror Lite infringed its alleged common law trademark rights in its product numbering system; infringed the trade dress of its "Hawk Eye" mirrors; and infringed its alleged common law trademark rights in the "Eagle Eye" mark. It is not clear whether Rosco's common law trademark claim as to its product numbering system is at issue on appeal, but we find no error with the district court's rejection of that claim. As for the trade dress claim, the district court concluded that Rosco abandoned its trade dress claim in light of the Supreme Court's decision in *Wal-Mart Stores, Inc. v. Samara Brothers, Inc., 529 U.S. 205, 216, 146 L. Ed. 2d 182, 120 S. Ct. 1339 (2000)*. Rosco does not argue to the contrary. Finally, the district court found that Rosco abandoned its claim that its alleged common law trademark rights in the "Eagle Eye" mark were infringed. We do not understand this ruling to be challenged on appeal.

[\*\*27]

Finally, we have considered Mirror Lite's procedural objections and find them to be without merit.

#### CONCLUSION

On remand, the following issues should be addressed on the basis of the existing trial record:

- 1) whether Mirror Lite has shown by clear and convincing evidence that Rosco's '357 design patent is invalid under *35 U.S.C. § 103*;
- 2) whether Rosco has shown by preponderant evidence that Mirror Lite

304 F.3d 1373, \*; 2002 U.S. App. LEXIS 20206, \*\*;  
64 U.S.P.Q.2D (BNA) 1676

infringed (if valid) Rosco's '357 design patent;

3) whether Rosco has shown by clear and convincing evidence that Mirror Lite's '984 patent is invalid under *35 U.S.C. §§ 102(a), 102(f), and 103*, considering each claim separately;

4) whether Rosco has shown by clear and convincing evidence that Mirror Lite's '984 patent is unenforceable due to inequitable conduct;

5) whether Mirror Lite has shown by preponderant evidence that Rosco

infringed any valid claim of its '984 patent (if those claims are valid and enforceable); and

6) whether Rosco has shown that Mirror Lite engaged in tortious interference with business relations through inequitable conduct in procuring the '984 patent.

COSTS

No costs.

[\*\*28] AFFIRMED-IN-PART, REVERSED-IN-PART, VACATED-IN-PART, and REMANDED.

**EXHIBIT G**

LEXSEE 49 USPQ 2D 1949

**IN RE ANTHONY J. ROBERTSON and CHARLES L. SCRIPPS**

98-1270

**UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT**

*169 F.3d 743; 1999 U.S. App. LEXIS 3224; 49 U.S.P.Q.2D (BNA) 1949*

**February 25, 1999, Decided**

**PRIOR HISTORY:** [\*\*1]Appealed from: Patent and Trademark Office Board of Patent Appeals and Interferences. (Serial No. 08/171,484).

**DISPOSITION:** REVERSED.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Appellant challenged the judgment of the Patent and Trademark Office Board of Patent Appeals and Interferences, which found that a claim in appellant's patent application was anticipated by and obvious over appellee's patent.

**OVERVIEW:** Because the evidence relied upon by the Board of Patent Appeals and Interferences (board) was insufficient to establish inherency, the court reversed the board's judgment. The devices in question involved diaper fasteners. On appeal, the court stated that to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter was necessarily present in the thing described in the reference and that it would be so recognized by persons of ordinary skill. Because the board failed to cite extrinsic evidence indicating that the devices in question performed the same function, its finding of inherency was insufficient because it rested upon probabilities or possibilities.

**OUTCOME:** The court reversed the judgment of the Board of Patent Appeals and Interferences because the evidence upon which its decision was based was insufficient to establish inherency in that it rested on probabilities and possibilities.

**LexisNexis(R) Headnotes**

***Patent Law > Anticipation & Novelty > General Overview***

[HN1] Anticipation under 35 U.S.C.S. § 102(e) requires that each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.

***Patent Law > Anticipation & Novelty > General Overview***

[HN2] If the prior art reference does not expressly set forth a particular element of the claim, that reference still may anticipate if that element is "inherent" in its disclosure. To establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.

**COUNSEL:** Kenneth R. Adamo, Jones, Day, Reavis & Pogue, of Cleveland, Ohio, argued for appellant. With him on the brief were Calvin P. Griffith, and Gregory A. Castanias, of Washington, DC. Of counsel on the brief was Steven W. Miller, The Proctor & Gamble Company, of Cincinnati, Ohio.

Linda Moncys Isacson, Associate Solicitor, Office of the Solicitor, of Arlington, Virginia, argued for appellee. With her on the brief were Albin F. Drost, Acting Solicitor, and John M. Whealan, Associate Solicitor.

**JUDGES:** Before NEWMAN, Circuit Judge, FRIEDMAN, Senior Circuit Judge, and RADER, Circuit Judge. Opinion for the court filed by Senior Circuit

169 F.3d 743, \*; 1999 U.S. App. LEXIS 3224, \*\*;  
49 U.S.P.Q.2D (BNA) 1949

Judge FRIEDMAN, in which Circuit Judge NEWMAN joins. Concurring opinion filed by Circuit Judge RADER.

#### OPINIONBY: FRIEDMAN

##### OPINION: [\*744] FRIEDMAN, Senior Circuit Judge:

This appeal challenges the decision of the Board of Patent Appeals and Interferences (Board) that claim 76 in the appellants' patent application was anticipated by and obvious over United States Patent No. 4,895,569 (the Wilson patent). We reverse.

#### I

Both claim 76 and [\*\*2] Wilson involve fastening and disposal systems for diapers. In both, the body of the diaper features a small front and a larger rear section. The outer edges of those sections are attached at the wearer's waist in the hip area. Once the diaper is soiled and then removed, the smaller front section is rolled up into the larger rear section and secured in this rolled-up configuration by fasteners.

The appellants' application is for "an improved mechanical fastening system for . . . disposable absorbent articles [i.e., diapers] that provides convenient disposal of the absorbent article." Claim 76 covers:

[A] mechanical fastening system for forming side closures . . . comprising

a closure member . . . comprising a first mechanical fastening means for forming a closure, said first mechanical fastening means comprising a first fastening element;

a landing member . . . comprising a second mechanical fastening means for forming a closure with said first mechanical fastening means, said second mechanical fastening means comprising a second fastening element mechanically engageable with said first element; and

disposal means for allowing the absorbent article [\*\*3] to be secured in a disposal configuration after use, said disposal means comprising a third mechanical fastening means for securing the absorbent article in the disposal configuration, said third mechanical fastening means comprising a third fastening element mechanically

engageable with said first fastening element . . .

Claim 76 thus provides for two mechanical fastening means to attach the diaper to the wearer and a third such means for securing the diaper for disposal.

The Wilson patent discloses two snap elements on fastening strips attached to the outer edges of the front and rear hip sections of the garment. The fastening strips may also include "secondary load-bearing closure means" - additional fasteners to secure the garment; they may be identical to the snaps.

Wilson also states:

Disposal of the soiled garment upon removal from the body is easily accomplished by folding the front panel . . . inwardly and then fastening the rear pair of mating fastener members . . . to one another, thus neatly bundling the garment into a closed compact package for disposal.

[\*745] In other words, Wilson does not provide a separate fastening means to be used in disposing of the [\*\*4] diaper. Instead, it suggests that disposal of the used diaper may be "easily accomplished" by rolling it up and employing the same fasteners used to attach the diaper to the wearer to form "a closed compact package for disposal."

In holding that the invention claim 76 covers was anticipated by Wilson, the Board did not hold that Wilson set forth a third fastening means. Instead, it found that Wilson anticipated claim 76 "under principles of inherency." Applying the language of claim 76 to the operation of Wilson, it concluded that "an artisan would readily understand the disposable absorbent garment of Wilson . . . as being inherently capable of [making the secondary load-bearing closure means] (third fastening element) mechanically engageable with [the other snap fasteners on the fastening strip] (first fastening element)" - i.e., using the secondary closure not with its mate, but with one of the primary snap fasteners. The Board summarily affirmed the examiner's alternative ruling that claim 76 would have been obvious in light of Wilson because "claim 76 lacks novelty."

#### II

[HN1] Anticipation under 35 U.S.C. § 102(e) requires that "each and every element as set forth in the [\*\*5] claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 631, 2 U.S.P.Q.2D (BNA) 1051, 1053 (Fed. Cir. 1987).

169 F.3d 743, \*; 1999 U.S. App. LEXIS 3224, \*\*;  
49 U.S.P.Q.2D (BNA) 1949

A. The Wilson patent does not expressly include a third fastening means for disposal of the diaper, as claim 76 requires. That means is separate from and in addition to the other mechanical fastening means and performs a different function than they do. Indeed, Wilson merely suggests that the diaper may be closed for disposal by using the same fastening means that are used for initially attaching the diaper to the body.

B. [HN2] If the prior art reference does not expressly set forth a particular element of the claim, that reference still may anticipate if that element is "inherent" in its disclosure. To establish inherency, the extrinsic evidence "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 U.S.P.Q.2D (BNA) 1746, 1749 (Fed. Cir. 1991). "Inherency, however, may not be established by probabilities or [\*\*6] possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Id.* at 1269, 20 U.S.P.Q.2D (BNA) at 1749 (quoting *In re Oelrich*, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981).

In finding anticipation by inherency, the Board ignored the foregoing critical principles. The Board made no attempt to show that the fastening mechanisms of Wilson that were used to attach the diaper to the wearer also "necessarily" disclosed the third separate fastening mechanism of claim 76 used to close the diaper for disposal, or that an artisan of ordinary skill would so recognize. It cited no extrinsic evidence so indicating.

Instead, the Board ruled that one of the fastening means for attaching the diaper to the wearer also could operate as a third fastening means to close the diaper for disposal and that Wilson therefore inherently contained all the elements of claim 76. In doing so, the Board failed to recognize that the third mechanical fastening means in claim 76, used to secure the diaper for disposal, was separate from and independent of the two other mechanical means used to attach the diaper to the person. The Board's theory that [\*\*7] these two fastening devices in Wilson were capable of being intermingled to perform the same function as the third and first fastening elements in claim 76 is insufficient to show that the latter device was inherent in Wilson. Indeed, the Board's analysis rests upon the very kind of probability or possibility - the odd use of fasteners with other than their mates - that this court has pointed out is insufficient to establish inherency.

### III

The Board's entire discussion of obviousness was as follows:

[\*746] The rejection of claim 76 under  
*35 USC § 103*

We sustain the rejection of claim 76 under  
*35 USC § 103*.

Above, we found that claim 76 lacks novelty. Lack of novelty is the ultimate of obviousness. See *In re Fracalossi*, 681 F.2d 792, 794, 215 U.S.P.Q. (BNA) 569, 571 (CCPA 1982). Thus, claim 76 is appropriately rejected under *35 USC § 103* as being unpatentable.

The "lack of novelty" upon which the Board based its conclusion of obviousness, however, was its finding of anticipation. Our rejection of that finding eliminates the sole basis of the Board's obviousness determination, which therefore cannot stand. See *In re Adams*, 53 C.C.P.A. 1433, 364 F.2d 473, 480, 150 U.S.P.Q. 646, [\*\*8] 651 (C.C.P.A. 1966).

In his brief the Commissioner argues:

Moreover, even if this court interprets claim 76 to require two separate fasteners to perform the closure and disposal functions, it would have been well within the knowledge of one of ordinary skill in the art to take Wilson's one fastener and make it into two separate fasteners. See [*In re Graves*, 69 F.3d [1147,] 1152, 36 U.S.P.Q.2D (BNA) [1697,] 1701 [(Fed. Cir. 1995)] (When evaluating a reference, it is appropriate to consider the knowledge of a skilled artisan in combination with the teaching of the reference.). Accordingly, claim 76 would have been obvious to one of ordinary skill in the art, and the rejection should be affirmed by this Court.

That, of course, was not the ground on which the Board based its obviousness ruling. We decline to consider counsel's newly-minted theory as an alternative ground for upholding the agency's decision. See *In re Soni*, 54 F.3d 746, 751, 34 U.S.P.Q.2D (BNA) 1684, 1688 (Fed. Cir. 1995) (citing *In re DeBlauwe*, 736 F.2d 699, 705 n.7, 222 U.S.P.Q. 191, 196 n.7 (Fed. Cir. 1984)). The Board's obviousness ruling cannot be sustained on the ground the Board gave. [\*\*9]

### CONCLUSION

The decision of the Board of Patent Appeals and Interferences affirming the examiner's rejection of claim

169 F.3d 743, \*; 1999 U.S. App. LEXIS 3224, \*\*;  
49 U.S.P.Q.2D (BNA) 1949

76 as anticipated by and obvious over the Wilson patent is

REVERSED.

**CONCURBY: RADER**

**CONCUR: RADER, Circuit Judge, concurring.**

Robertson asserts that the prior art Wilson patent does not teach three elements of claim 76: a "third mechanical fastening means," a disposal means on the "outside surface" of the body portion, and end regions that are "in an overlapping configuration when worn." In reversing the Board, this court relies solely on the purported failure of Wilson to teach the third fastening means. Because I believe Wilson teaches such a means, but does not teach the other two limitations at issue, I concur.

In its analysis, this court assumes without discussion that the claimed "third mechanical fastening means" covers a separate third mechanical fastening means. This issue is key, for if the claim does not require a separate third fastening means, but instead allows the first fastening means to also serve as the third, then the prior art Wilson patent clearly teaches that element of the claim. For two reasons, this claim does not, to my eyes, [\*\*10] require a separate third fastening means. First, the claim does not specifically recite a separate third fastening means. Second, because the claim is in means-plus-function form, this court consults the specification

to identify structure. The specification explicitly teaches that the first and third fastening elements can be the same so long as they are complementary, as they are in Wilson. Accordingly, I agree with the Board that Wilson teaches the claimed "third fastening element."

Wilson does not, however, teach either of the other two claim limitations at issue. As to the disposal means on the "outside surface" of the body portion, Wilson's figs. 12 and 13a-d show the disposal means on the inside of the body portion. As to the end regions that are "in an overlapping configuration when worn," Wilson explicitly teaches that the end regions should abut, not overlap, when worn. To overcome these teachings, the Board relied on the following statement in Wilson: "Further, the fastener members [\*747] need not be previously mounted on a separate strip as shown then bonded . . . to the stretchable outer cover . . . Multi-component snaps are available which may be applied directly to a [\*\*11] stretchable outer cover material . . ." Col. 7, l. 65 to col. 8, l. 3. The Board opined that applying snaps directly to the outer cover would result in both a disposal means on the "outside surface" and end regions "in an overlapping configuration when worn." Simply put, the Board has put more weight on this teaching than it can bear. It is far from clear what effect applying the snaps directly to the outer cover will have on the Wilson diaper configuration, let alone that it will result in a configuration satisfying the claim elements at issue. Accordingly, because I believe that the Board clearly erred in this interpretation of Wilson, I would reverse on this ground.

**EXHIBIT H**

LEXSEE 20 USPQ 2D 1746

**CONTINENTAL CAN COMPANY USA, INC. and CONTINENTAL PET TECHNOLOGIES, INC., Plaintiffs-Appellants, v. MONSANTO COMPANY, HOOVER UNIVERSAL, INC. and JOHNSON CONTROLS, INC., Defendants-Appellees**

No. 90-1328

**UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT**

**948 F.2d 1264; 1991 U.S. App. LEXIS 26994; 20 U.S.P.Q.2D (BNA) 1746**

November 13, 1991, Decided

**SUBSEQUENT HISTORY:**

Rehearing Denied December 26, 1991, Reported at: 1991 U.S. App. LEXIS 29979.

**PRIOR HISTORY:** [\*\*1]Appealed from: U.S. District Court for the Southern District of Ohio; Judge Spiegel.

**DISPOSITION:**

Reversed in Part, Vacated in Part, and Remanded.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Plaintiff appealed an order of United States District Court for the Southern District of Ohio that granted partial summary judgment in favor of defendant, in an action alleging patent infringement for the use of a plastic bottle bottom.

**OVERVIEW:** Plaintiff filed suit alleging patent infringement for defendant's use of a plastic bottle bottom structure. Plaintiff appealed the trial court's order of partial summary judgment for defendant. The court reversed and remanded. The court held summary judgment was not proper in light of 35 U.S.C.S. § 103, which required analysis of not whether the differences in the structure were simple enhancements, but whether it would have been obvious to make the claimed structure. The court found that there existed material issues of disputed facts, which precluded summary judgment, on the production of hollow ribs using a blow molding

process. The court also held that the trial court erred in determining that the patented bottle was on sale more than one year prior to application for patent, thereby barring patent entitlement. The court held that a product is not considered on sale until the availability of the product to the public.

**OUTCOME:** The court reversed an order granting defendant partial summary judgment and remanded because the trial court failed to determine whether it would have been obvious to make the claimed structure and erred in determining that the patented bottle was on sale even though it was not available to the public.

**LexisNexis(R) Headnotes**

***Civil Procedure > Summary Judgment > Summary Judgment Standard***

[HN1] An issue may be decided on motion for summary judgment when there is no genuine issue of material fact, and the movant is entitled to judgment as a matter of law.

***Civil Procedure > Summary Judgment > Summary Judgment Standard***

[HN2] The movant's burden in a summary judgment motion is to show that no fact material to the issue is in dispute, that even if all material factual inferences are drawn in favor of the non-movant the movant is entitled to judgment as a matter of law.

***Patent Law > Infringement Actions > Summary Judgment > General Overview***

948 F.2d 1264, \*; 1991 U.S. App. LEXIS 26994, \*\*;  
20 U.S.P.Q.2D (BNA) 1746

[HN3] Summary judgment is as available in patent cases as in other areas of litigation.

**Patent Law > Anticipation & Novelty > General Overview**

[HN4] See 35 U.S.C.S. § 102(a).

**Patent Law > Anticipation & Novelty > General Overview**

[HN5] Anticipation under 35 U.S.C.S. § 102(a) requires that the identical invention that is claimed was previously known to others and thus is not new.

**Patent Law > Nonobviousness > Evidence & Procedure > Presumptions & Proof**

**Patent Law > Inequitable Conduct > General Overview**

**Patent Law > Anticipation & Novelty > General Overview**

[HN6] When more than one reference is required to establish unpatentability of the claimed invention anticipation under 35 U.S.C.S. § 102 can not be found, and validity is determined in terms of 35 U.S.C.S. § 103.

**Patent Law > Anticipation & Novelty > General Overview**

[HN7] To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.

**Patent Law > Anticipation & Novelty > Elements**

**Patent Law > Claims & Specifications > Enablement Requirement > General Overview**

[HN8] Modest flexibility in the rule that "anticipation" requires that every element of the claims appear in a single reference accommodates situations where the common knowledge of technologists is not recorded in the reference; that is, where technological facts are known to those in the field of the invention, albeit not known to judges. It is not, however, a substitute for determination of patentability in terms of 35 U.S.C.S. § 103.

**Patent Law > Statutory Bars > On Sale Bar > General Overview**

**Patent Law > Statutory Bars > Public Use Bar > General Overview**

[HN9] See 35 U.S.C.S. § 102(b).

**Patent Law > Statutory Bars > On Sale Bar > General Overview**

[HN10] The on sale bar of 35 U.S.C.S. § 102(b) does not arise simply because the intended customer was participating in development and testing.

**Patent Law > Statutory Bars > On Sale Bar > General Overview**

[HN11] Various factors pertinent to the on sale bar when there is an issue concerning the relationship between the patentee and the customer are: whether there was a need for testing by other than the patentee; the amount of control exercised; the stage of development of the invention; whether payments were made and the basis thereof; and whether confidentiality was required; and whether technological changes were made. All of the circumstances attending the relationship must be considered in light of the public policy underlying 35 U.S.C.S. § 102(b).

**Patent Law > Statutory Bars > On Sale Bar > General Overview**

[HN12] The on sale bar is measured by the time the public came into possession of the invention. What starts the period running is the availability of the invention to the public through the categories of disclosure enumerated in 35 U.S.C.S. § 102(b).

**Patent Law > Claims & Specifications > Enablement Requirement > General Overview**

**Patent Law > Nonobviousness > Elements & Tests > General Overview**

[HN13] Obviousness, 35 U.S.C.S. § 103, is reviewed as a legal conclusion based upon underlying facts of four general categories: the scope and content of the prior art, the differences between the prior art and the claimed invention, the level of ordinary skill at the time the invention was made, and any objective considerations that may be present.

**Patent Law > Nonobviousness > Elements & Tests > General Overview**

[HN14] When differences that may appear technologically minor nonetheless have a practical impact, particularly in a crowded field, the court must consider the obviousness of the new structure in this light. Such objective indicia as commercial success, or filling an existing need, illuminate the technological and commercial environment of the inventor, and aid in understanding the state of the art at the time the invention was made.

**Patent Law > Nonobviousness > Elements & Tests > Secondary Considerations**

[HN15] It is not necessary that the patented invention be solely responsible for the commercial success in order for this factor to be given weight appropriate to the

948 F.2d 1264, \*; 1991 U.S. App. LEXIS 26994, \*\*;  
20 U.S.P.Q.2D (BNA) 1746

evidence, along with other pertinent factors, in determining obviousness.

#### COUNSEL:

Eugene F. Friedman, Eugene F. Friedman, Ltd., of Chicago, Illinois, argued for Plaintiffs-Appellants. With him on the brief were Edwin C. Thomas, III and David M. Novak, Bell, Boyd & Lloyd, of Chicago, Illinois. Also on the brief was Kurt L. Grossman, Wood, Herron & Evans, of Cincinnati, Ohio.

Henry J. Renk, Fitzpatrick, Cella, Harper & Scinto, of New York, New York, argued for Defendants-Appellees. With him on the brief were Lawrence F. Scinto and Bruce C. Haas. Also on the brief were Jacob K. Stein, Deborah DeLong, Thompson, Hine & Flory, of Cincinnati, Ohio, Lawrence L. Limpus, Monsanto Company, of St. Louis, Missouri and Edward L. Levine, Johnson Controls, Inc., of Milwaukee, Wisconsin.

#### JUDGES:

Newman, Archer, and Rader, Circuit Judges.

#### OPINIONBY:

NEWMAN

#### OPINION:

[\*1265] NEWMAN, Circuit Judge

Continental Can Company USA and Continental PET Technologies (collectively "Continental") appeal the partial summary judgment of the United States District Court for the Southern District of Ohio, holding that United States Patent No. 4,108,324 (the Conobase or '324 [\*\*2] patent) is invalid. n1 Final judgment was entered on this issue, for the purpose of appeal.

n1 *Continental Can Co. USA v. Monsanto Co.*, 1989 U.S. Dist. LEXIS 13417, 11 U.S.P.Q.2d (BNA) 1761 (S.D. Ohio 1989), reconsid. denied, No. C-1-86-1213 (S.D. Ohio Nov. 9, 1989).

#### *Summary Judgment*

[HN1] An issue may be decided on motion for summary judgment when there is no genuine issue of material fact, and the movant is entitled to judgment as a matter of law. *Fed. R. Civ. P. 56(c); Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 91 L. Ed. 2d 202, 106 S. Ct. 2505 (1986); *Celotex Corp. v. Catrett*, 477 U.S. 317, 325-26, 91 L. Ed. 2d 265, 106 S. Ct. 2548 (1986);

*Scripps Clinic & Research Foundation v. Genentech, Inc.*, 927 F.2d 1565, 1571, 18 U.S.P.Q.2d (BNA) 1001, 1005 (Fed. Cir. 1991). [HN2] The movant's burden is to show that no fact material to the issue is in dispute, that even if all material factual inferences are drawn in favor of the non-movant the movant is entitled to judgment as a matter of law. *Id.* [HN3] Summary judgment is as available in patent cases [\*\*3] as in other areas of litigation. *Chore-Time Equipment, Inc. v. Cumberland Corp.*, 713 F.2d 774, 778-79, 218 U.S.P.Q. (BNA) 673, 675 (Fed. Cir. 1983)

The purpose of the summary process is to avoid a clearly unnecessary trial, *Matsushita Elec. Industrial Co. v. Zenith Radio Corp.*, 475 U.S. 574, 587, 89 L. Ed. 2d 538, 106 S. Ct. 1348 (1986); it is not designed to substitute lawyers' advocacy for evidence, or affidavits for examination before the fact-finder, when there is a genuine issue for trial. As stated in *Adickes v. S.H. Kress & Co.*, 398 U.S. 144, 176, 26 L. Ed. 2d 142, 90 S. Ct. 1598 (1970) (Black, J., concurring), "the right to confront, cross-examine and impeach adverse witnesses is one of the most fundamental rights sought to be preserved by the Seventh Amendment". See also *Poller v. Columbia Broadcasting System, Inc.*, 368 U.S. 464, 473, 7 L. Ed. 2d 458, 82 S. Ct. 486 (1962).

While facilitating the disposition of legally meritless suits, when summary judgment [\*1266] is improvidently granted the effect is to prolong litigation and increase its burdens. This is of particular concern in patent disputes, where the patent property is a wasting asset, and justice is ill served by delay in final resolution. [\*\*4] In the case at bar, although some issues could be resolved on the law and undisputed facts, other issues require trial.

#### *The Patented Invention*

The '324 patent, entitled "Ribbed Bottom Structure for Plastic Container", inventors Suppayan M. Krishnakumar, Siegfried S. Roy, John F. E. Pocock, Salil K. Das, and Gautam K. Mahajan, is directed to a plastic bottle whose bottom structure has sufficient flexibility to impart improved impact resistance, combined with sufficient rigidity to resist deformation under internal pressure. The patented bottle is said to provide a superior combination of these properties. The bottom structure is illustrated as follows:

[SEE FIG 2 IN ORIGINAL]

Claim 1 is the broadest claim of the '324 patent:

1. A container having a sidewall and a bottom structure closing the container at an end portion of the sidewall,

948 F.2d 1264, \*; 1991 U.S. App. LEXIS 26994, \*\*;  
20 U.S.P.Q.2D (BNA) 1746

the outer surface of the bottom structure comprising a central concavity,

a convex heel surrounding the concavity and merging therewith and with the sidewall end portion, the lowermost points of the heel lying in a common plane,

and a plurality of ribs interrupting the outer surface of the concavity and distributed in a symmetrical [\*\*5] array,

each rib extending longitudinally in the direction of the heel and downwardly from an inner portion of the concavity, whereby the outer end portion of each rib is lower than the inner end portion thereof,

characterized by the feature that the ribs are hollow.

Claims 2 through 5 include additional limitations, described as contributing to the structure's rigidity, flexibility, or both. Claim 2 specifies the ratios of thickness of the walls of the bottom structure to the thickness of the sidewall end portions. Claim 3 specifies that the margins of each rib merge smoothly with adjacent portions of the bottom structure. Claim 4 specifies that each rib is convex relative to the bottom structure. Claim 5 specifies that each rib is of fusiform (a gently tapered shape at the ends) configuration. Each claim carries an independent presumption of validity, [\*1267] 35 U.S.C. § 282, and stands or falls independent of the other claims. *Altoona Publix Theatres, Inc. v. American Tri-Ergon Corp.*, 294 U.S. 477, 487, 79 L. Ed. 1005, 55 S. Ct. 455 (1935).

Continental brought suit for patent infringement against Monsanto Company and Monsanto's successor in this business, Hoover Universal, Inc. and Hoover's parent [\*\*6] company, Johnson Controls (collectively "Monsanto"). Monsanto moved for partial summary judgment based on issues of validity under 35 U.S.C. §§ 102 and 103.

## I

35 U.S.C. § 102(a)

The statutory requirement that a patented invention be "new" is tested in accordance with 35 U.S.C. § 102(a), which provides that:

§ 102. [HN4] A person shall be entitled to a patent unless--

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent. . . .

The district court found that all the claims of the '324 patent were anticipated by U.S. Patent No. 3,468,443 (the Marcus patent). We conclude that the district court erred in claim interpretation, and also found disputed facts adversely to the nonmovant, thus inappropriately deciding the issue summarily.

[HN5] Anticipation under § 102(a) requires that the identical invention that is claimed was previously known to others and thus is not new. *Scripps Clinic*, 927 F.2d at 1576, 18 U.S.P.Q.2d at 1010; *Titanium Metals Corp. of Am. v. Banner*, 778 F.2d 775, 780, 227 U.S.P.Q. (BNA) 773, 777-78 (Fed. Cir. 1985); [\*\*7] *Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick Co.*, 730 F.2d 1452, 1458, 221 U.S.P.Q. (BNA) 481, 485 (Fed. Cir. 1984). [HN6] When more than one reference is required to establish unpatentability of the claimed invention anticipation under § 102 can not be found, and validity is determined in terms of § 103.

It was Monsanto's burden to show that every element of the several claims of the '324 patent was identically described in the asserted anticipating reference, the Marcus patent. The district court focused on the term "characterized by the feature that the ribs are hollow", which limits all of the '324 patent claims. Continental argues that the district court incorrectly construed this term, as a matter of law, and that the Marcus patent shows ribs that are not hollow, as that term is used in the '324 patent. Continental also points to other differences between the '324 claims and the description in the Marcus patent.

The Marcus patent rib structure is illustrated in Figure 5 and in cross-section in Figure 6:

[SEE FIG.5 IN ORIGINAL]

[SEE FIG.6 IN ORIGINAL]

[\*1268] The Marcus patent does not state that its ribs are "hollow", or use a similar term. Continental's witnesses [\*\*8] testified by deposition that the Marcus patent shows solid, not hollow, ribs. A witness (Adomaitis) had stated in an internal memorandum written at Continental in 1969, well before this litigation arose, that "the ribs of their [Marcus'] web can be made of solid beams only." Another witness, '324 co-inventor Pocock, testified that:

948 F.2d 1264, \*; 1991 U.S. App. LEXIS 26994, \*\*;  
20 U.S.P.Q.2D (BNA) 1746

It seems evident to me that he [Marcus] was trying to produce some kind of container integrity by the production of essentially solid ribs on the bottom of the bottle. It seems to go to great length here to illustrate them as such.

Krishnakumar, another co-inventor, testified that it "is very obvious the ribs are shown solid", and that Figures 5 and 6 as well as Figures 7 through 12 of the Marcus patent all show solid ribs. However, Marcus, testifying for Monsanto, testified that his ribs were hollow, and that conventional blow molding would inherently produce hollow ribs.

The district court defined "hollow" as meaning that "the inside contour of the ribs generally follows the outside contour thereof", a definition on which the parties agreed. *Continental*, 11 U.S.P.Q.2d at 1764. See the court's opinion, 11 U.S.P.Q.2d at 1764-68, [\*\*9] for various sketches made by the witnesses. *Continental* states that the district court erred in construing "hollow", and that the phrase "characterized by the feature that the ribs are hollow" must be construed in terms of the patent in which it appears. See, e.g., *Tandon Corp. v. United States Int'l Trade Comm'n*, 831 F.2d 1017, 1021, 4 U.S.P.Q.2d (BNA) 1283, 1286 (Fed. Cir. 1987). The '324 patent explicitly distinguished the Marcus patent teachings, stating that the '324 ribs are, unlike Marcus, not filled with plastic. The '324 specification uses the term "hollow", as do the prosecution history and the claims, for this purpose. The '324 patent's usage of "hollow" is illustrated in the rib cross-section in Figure 5A:

[SEE FIG 5A IN ORIGINAL]

The Marcus patent's rib structure thus was explicitly differentiated by the term "hollow" as used in the '324 specification, drawings, and prosecution history. Since the claim term must be construed as used by the patentee, the district court erred in its construction of the '324 claim term "hollow". On correct claim construction, the factual question of anticipation must be decided.

Monsanto's argument is that hollow [\*\*10] ribs were inherently produced by Marcus. Monsanto thus argues that anticipation lies because the Marcus patent's ribs are "inherently" hollow, regardless of how they are shown in the Marcus patent. Monsanto argues that because the Marcus ribs are formed by injection blow molding, which is the same process described for the

Conobase '324 ribs, hollow ribs are inherently disclosed in the Marcus patent.

[HN7] To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. *In re Oelrich*, 666 F.2d 578, 581, 212 U.S.P.Q. (BNA) 323, 326 (CCPA 1981) (quoting *Hansgirg v. Kemmer*, 26 C.C.P.A. 937, 102 F.2d 212, 214, 40 U.S.P.Q. (BNA) 665, 667 (CCPA 1939)) provides:

[\*1269] Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient. [Citations omitted.] If, [\*\*11] however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

This [HN8] modest flexibility in the rule that "anticipation" requires that every element of the claims appear in a single reference accommodates situations where the common knowledge of technologists is not recorded in the reference; that is, where technological facts are known to those in the field of the invention, albeit not known to judges. It is not, however, a substitute for determination of patentability in terms of § 103.

*Continental* does not dispute the applicability of the injection blow molding process. However, *Continental* disputes the material fact of whether this process necessarily produced "hollow" ribs in the Marcus base structure, as the term "hollow" is used in the '324 patent. Resolution of this disputed fact adversely to *Continental* was improper on summary judgment. The grant of summary judgment of anticipation under § 102(a) is vacated. The issue requires trial.

## II

35 U.S.C. § 102(b)

948 F.2d 1264, \*; 1991 U.S. App. LEXIS 26994, \*\*;  
20 U.S.P.Q.2D (BNA) 1746

The district court also held that [\*\*12] the Marcus bottle was on sale, 35 U.S.C. § 102(b). Section 102(b) bars entitlement to a patent when:

[HN9] (b) the invention was . . . in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States.

...

The Marcus bottle was developed some ten years before the filing date of the '324 patent, during a project wherein Marcus' employer, Admiral Plastics or APL Corporation, entered into agreements with the Coca-Cola Company for the development of a suitable plastic bottle. The agreements provided that Admiral Plastics would make and Coca-Cola would test the bottles, and that if a satisfactory bottle was developed it would be manufactured by Admiral and purchased by Coca-Cola. Minimum commercial quantities and maximum commercial prices were stated in an agreement, and costs were a matter of discussion. Admiral produced a variety of bottle shapes, including the Marcus bottle. The project was terminated after about two years, because the "mechanical performance" requirements were not met, as Coca-Cola wrote at the time.

The district court reasoned that this project "called for the eventual marketing of the Marcus bottles once [\*\*13] all technical difficulties were resolved", *Continental*, 11 U.S.P.Q.2d at 1766, and on this basis held that the Marcus bottles were on sale. This holding was in error, for [HN10] the "on sale" bar of § 102(b) does not arise simply because the intended customer was participating in development and testing. See *Great Northern Corp. v. Davis Core & Pad Co.*, 782 F.2d 159, 164-65, 228 U.S.P.Q. (BNA) 356, 358 (Fed. Cir. 1986). In *Baker Oil Tools, Inc. v. Geo Vann, Inc.*, 828 F.2d 1558, 1563-65, 4 U.S.P.Q.2d (BNA) 1210, 1213-15 (Fed. Cir. 1987), this court summarized [HN11] various factors pertinent to the "on sale" bar when there is an issue concerning the relationship between the patentee and the customer: for example, whether there was a need for testing by other than the patentee; the amount of control exercised; the stage of development of the invention; whether payments were made and the basis thereof; whether confidentiality was required; and whether technological changes were made. All of the circumstances attending the relationship must be considered in light of the public policy underlying § 102(b). *UMC Electronics Co. v. United States*, 816 F.2d 647, 656, 2 U.S.P.Q.2d (BNA) 1465, 1471-72 (Fed. Cir. 1987), [\*\*14] cert. denied, 484 U.S. 1025, 98 L. Ed. 2d 761, 108 S. Ct. 748 (1988).

The district court acknowledged that all technical difficulties were not resolved and that no sales were ever made. [\*1270] Although Admiral Plastics' hope was surely commercial sales, and the record shows that prices and quantities were discussed, this does not of itself place the subject matter "on sale" in the sense of § 102(b). The Marcus bottle was part of a terminated development project that never bore commercial fruit and was cloaked in confidentiality. While the line is not always bright between development and being on sale, see generally *UMC Electronics*, *supra*, in this case the line was not crossed. [HN12] The "on sale" bar is measured by "the time the public came into possession of the invention", *id. at 655*, 2 U.S.P.Q.2d at 1471 (quoting *In re Foster*, 52 C.C.P.A. 1808, 343 F.2d 980, 987-88, 145 U.S.P.Q. (BNA) 166, 173 (CCPA 1965), cert. denied, 383 U.S. 966, 16 L. Ed. 2d 307, 86 S. Ct. 1270, 149 U.S.P.Q. (BNA) 906 (1966) ("What starts the period running is clearly the availability of the invention to the public through the categories of disclosure enumerated in 102(b). . . ." (emphasis in original))). [\*\*15] We conclude that the district court erred in holding that the circumstances that here existed placed the Marcus bottles "on sale" in terms of § 102(b). We therefore reverse and direct that on remand judgment on this issue shall be entered in favor of Continental, as a matter of law.

### III

#### 35 U.S.C. § 103

[HN13] Obviousness, 35 U.S.C. § 103, is reviewed as a legal conclusion based upon underlying facts of four general categories, *viz.* the scope and content of the prior art, the differences between the prior art and the claimed invention, the level of ordinary skill at the time the invention was made, and any objective considerations that may be present. *Graham v. John Deere Co.*, 383 U.S. 1, 17, 15 L. Ed. 2d 545, 86 S. Ct. 684, 148 U.S.P.Q. (BNA) 459 (1966); *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1137-38, 227 U.S.P.Q. (BNA) 543, 547 (F.C. Cir. 1985).

The parties agreed that the scope and content of the prior art was adequately represented by four references: the Marcus patent discussed in Part I *ante*, a patent to Colombo (U.S. Patent No. 3,403,804), and two patents owned by Continental, U.S. Patent No. 3,598,270 (the Petaloid patent), and No. 3,935,955 (the Decaloid patent). They agreed [\*\*16] on little else. In granting summary judgment of invalidity for obviousness, the district court found certain disputed material facts and misapplied certain precepts of law. We conclude that the issue was not amenable to summary resolution. Although it is not entirely clear how the references were combined by the court, we shall review the references briefly, in order to explain our conclusion.

948 F.2d 1264, \*; 1991 U.S. App. LEXIS 26994, \*\*;  
20 U.S.P.Q.2D (BNA) 1746

#### *The Petaloid Patent*

The district court referred to the deposition testimony of Siegfried Roy, one of the co-inventors of the '324 patent, that the Petaloid base, inverted, was similar to the Conobase. Continental points out that neither Roy nor any other deponent suggested that the Petaloid base could be or should be inverted, or that inversion would provide an improved base structure. In *In re Gordon*, 733 F.2d 900, 902, 221 U.S.P.Q. (BNA) 1125, 1127 (Fed. Cir. 1984) this court held that although a prior art device could have been turned upside down, that did not make the modification obvious unless the prior art fairly suggested the desirability of turning the device upside down.

Continental points out that the Petaloid description differs in several other ways from [\*\*17] the '324 invention. In the '324 structure the outer end of each rib is lower than the inner end, whereas in the Petaloid structure the outer ends of the ribs are higher than the inner ends; that is, the ribs in the Petaloid base extend upward from the center to the sidewall. The Petaloid bottle is supported on feet extending between the ribs, such feet being the locations for stress concentrations. The following drawing is from the Petaloid patent:

[\*1271] [SEE FIG 3 IN ORIGINAL]

Continental states that the '324 Conobase is not only different, but avoids the stress concentrations of the Petaloid device, thus enhancing impact resistance. Monsanto argues that Continental simply used the Petaloid hollow ribs in combination with the Marcus patent. This requires determination of whether there was something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination, in a way that would produce the '324 structure. See, e.g., *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 1051, 5 U.S.P.Q.2d (BNA) 1434, 1438 (Fed. Cir.), cert. denied, 488 U.S. 825, 102 L. Ed. 2d 51, 109 S. Ct. 75 (1988). Continental argues that it is not apparent, [\*\*18] even with hindsight, how any combination of the Petaloid and Marcus patents or other references lead to the '324 base. The Petaloid patent shows concave ribs that extend all the way to the sidewall, while the Marcus ribs extend "from the heel" toward an annular central ring. The Petaloid base has wide, petal-like, open ribs, while Marcus shows narrow, beam-like ribs. The deposition testimony was in conflict as to the inferences drawn from the references.

On this disputed issue, drawing reasonable inferences in favor of the non-movant, it has not been established that one skilled in the art would be motivated to select and combine features from each source in order to make the '324 base. *Interconnect Planning*, 774 F.2d

at 1143, 227 U.S.P.Q. at 551 ("When prior art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gleaned from the invention itself").

#### *The Decaloid Patent*

The district court also referred to combination of the Decaloid base with the Marcus base. The Decaloid base has ten hollow ribs that extend to the sidewall, and ten feet [\*\*19] between the ribs:

[\*1272] [SEE FIG 2 IN ORIGINAL]

Monsanto does not explain, and we can not discern, how the combination with Marcus would have led a person of ordinary skill to the '324 base. The court's summary holding of obviousness based on these references, separately or in combination, can not be sustained.

#### *The Colombo Patent*

The Colombo base, like the Petaloid and Decaloid bases, has hollow ribs that extend to the sidewall, in a still different structure from that of Marcus and also from that of the '324 patent. Colombo describes his ribs as inverted U-shapes, concave, located on the outer surface of the central concavity:

[SEE FIG. 4 IN ORIGINAL]

Again, drawing reasonable factual inferences in favor of Continental, and in the absence of any suggestion or motivation in the prior art as a whole to make a selective combination of the Colombo and Marcus [\*1273] structures along with other changes needed to obtain the '324 structure, summary judgment of obviousness was inappropriate.

The district court found that there was no substantial difference between the '324 invention and the combined teachings of the prior art:

As obviousness can be established on the basis of the combined [\*\*20] teachings of references, we think it is clear that simple enhancements of existing prior art, i.e. inverting the '270 petaloid base, do not constitute a substantial difference between the subject matter claimed in the '324 patent and that of the prior art. Thus, the facts of this case reveal no substantial difference between '324 and the prior art.

948 F.2d 1264, \*; 1991 U.S. App. LEXIS 26994, \*\*;  
20 U.S.P.Q.2D (BNA) 1746

*Continental*, 11 U.S.P.Q.2d at 1769 (citation omitted). However, as we have discussed, the criterion of § 103 is not whether the differences from the prior art are "simple enhancements", but whether it would have been obvious to make the claimed structure.

#### *Objective Indicia*

The district court concluded that the structure in suit is simply a variation on known themes. It is in such circumstance that the objective indicia -- the so-called secondary considerations -- are most useful to the decision-maker. The significance of a new structure is often better measured in the marketplace than in the courtroom.

Thus [HN14] when differences that may appear technologically minor nonetheless have a practical impact, particularly in a crowded field, the decision-maker must consider the obviousness of the new structure in this light. Such [\*\*21] objective indicia as commercial success, or filling an existing need, illuminate the technological and commercial environment of the inventor, and aid in understanding the state of the art at the time the invention was made. See *In re Piasecki*, 745 F.2d 1468, 1475, 223 U.S.P.Q. (BNA) 785, 790 (Fed. Cir. 1984) (secondary considerations "often establish that an invention appearing to have been obvious in light of the prior art was not" (quoting *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538-39, 218 U.S.P.Q. (BNA) 871, 879 (Fed. Cir. 1983))).

Continental licensed the '324 counterpart Japanese patent to a Japanese company, Yoshino, that we are told had been unable to develop a plastic bottle for hot-fill applications. A witness for Toyo Seikan, another Japanese licensee, testified that the Conobase "sustains itself in higher temperatures, and it does not cause buckling after you fill [the bottle]", as compared with previously available plastic bottles. Continental asserts that Monsanto had been unable to develop a satisfactory

bottle for hot-fill applications, and had therefore obtained this technology from Yoshino.

The district court [\*\*22] acknowledged the commercial success of the Conobase, but stated that "we are not convinced that the Conobase alone accounts for any of the success." 11 U.S.P.Q.2d at 1770 (emphasis in original). The court suggested that the commercial success in Japan was due to the market strength of the Japanese licensees, and held that there is no nexus between the merits of the product and its commercial success. [HN15] It is not necessary, however, that the patented invention be solely responsible for the commercial success, in order for this factor to be given weight appropriate to the evidence, along with other pertinent factors. See generally *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392-94, 7 U.S.P.Q.2d (BNA) 1222, 1226-28 (Fed. Cir.), cert. denied, 488 U.S. 956, 102 L. Ed. 2d 383, 109 S. Ct. 395 (1988); *Rosemount, Inc. v. Beckman Instruments, Inc.*, 727 F.2d 1540, 1546, 221 U.S.P.Q. (BNA) 1, 7 (Fed. Cir. 1984). Monsanto also states that the Conobase is different from the '324 invention, so that even were the Conobase successful, this does not inure to the benefit of the '324 patent. It is apparent that the factual issues surrounding [\*\*23] the objective indicia were disputed, and material.

In view of the material facts requiring resolution, the issue of obviousness was not properly decided on motion for summary [\*1274] judgment. We vacate the grant based on 35 U.S.C. § 103, and remand for trial of this issue and the other issues remaining in the case.

#### *Costs*

Costs in favor of Continental.

REVERSED IN PART, VACATED IN PART, and REMANDED.

**EXHIBIT I**

## Survey of Microorganisms for the Production of Extracellular Phytase

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Received for publication 19 April 1968

A culture enrichment technique was used to isolate phytase-producing microorganisms. Also, microorganisms from various culture collections were tested for their phytase-producing ability. A number of the *Aspergillus niger* group produced extracellular phytase which dephosphorylated calcium phytate in acidic solution. A soil isolate, *A. ficuum* NRRL 3135, produced the most active phytase in a corn-starch-based medium. Production of phytase was strongly repressed by inorganic phosphates and required a high carbon to phosphorus ratio in the medium.

Many species of plants contain appreciable amounts of phytate phosphorus (2). This organically bound form of phosphorus is poorly utilized by monogastric animals, such as poultry and swine (10, 14), because their simple digestive tract cannot hydrolyze substantial amounts of phytate. Selective enzymatic hydrolysis of phytate phosphorus should release the phosphorus in a form available to the animal. Enzymes of this type have been found in wheat bran (9), in various plant seeds (7, 8, 11), in plant storage organs such as potato (6), in tobacco leaves (13), and have been obtained from microorganisms (1, 3, 5, 12). This paper describes the screening of various microorganisms to determine which ones are producers of highly active extracellular acid phytase. Factors affecting production of this enzyme by a mold are also presented.

### MATERIALS AND METHODS

*Preparation of calcium phytate.* Calcium phytate, free of orthophosphate, was prepared by a modification of the procedures of Common (2) and Casida (1). Crude sodium phytate (30 g; Nutritional Biochemicals Corp., Cleveland, Ohio) was dissolved in 250 ml of 0.15 N HCl, and undissolved impurities were removed by filtration. The clear supernatant fluid was neutralized to phenolphthalein with 25% (w/v) NaOH solution, and 110 ml of 10% (w/v) FeCl<sub>3</sub> was added. Iron phytate was recovered by centrifugation and washed three times with 800 ml of 0.15 N HCl to remove ferric phosphate. The white iron phytate was resuspended in water, and portions of 5% (w/v) NaOH solution were added until no additional brown precipitate formed. The supernatant liquid was adjusted to pH 7.0, and portions of 20% (w/v) calcium

acetate were added until no further precipitate formed. The calcium phytate was washed three times with 500 ml of methanol and air-dried to a white powder.

*Organisms.* A few of the microorganisms tested for extracellular phytase production were isolated from enrichment cultures. Other cultures tested were obtained from the American Type Culture Collection, Rockville, Md., and from the cultural collections of Purdue University and the University of Wisconsin.

*Screening techniques for isolating phytase-producing organisms.* Enrichment culture media containing calcium phytate as the sole phosphorus and carbon source were used for the primary screening of phytase producers. The method takes advantage of the insolubility of calcium phytate in aqueous media which gives a white turbidity in an agar plate. At least four different media containing 0.5% (w/v) calcium phytate were used for the plate screening method: (i) Czapek's medium with the omission of phosphate and sucrose was used as a phosphate- and carbon-deficient mineral medium; (ii) Czapek's medium without phosphate was used as a phosphate-deficient medium; (iii) malt-yeast extract medium was employed for fungi; and (iv) nutrient medium was used for bacteria. Every medium used was sterilized by autoclaving at 121°C for 15 min.

When diluted soil samples were seeded into the agar plate, any developing colony which produced a clear zone was considered a potential phytase producer. Any colony that developed in media (i) or (ii) and any colony that developed a clear zone in either media (iii) or (iv) was isolated. Flask tests were made in the following fermentation media. (i) Malt-yeast extract broth consisted of (per liter): malt extract (Difco), 3.0 g; yeast extract (Difco), 3.0 g; peptone (Difco), 0.5 g; and glucose (Difco), 10 g; pH 6.8. (ii) Corn-starch medium consisted of (per liter): cornstarch (Hubinger), 80 g; glucose, 30 g; MgSO<sub>4</sub>·7H<sub>2</sub>O, 0.5 g; KCl, 0.5 g; FeSO<sub>4</sub>, 0.1 g; NaNO<sub>3</sub>, 8.6 g; K<sub>2</sub>HPO<sub>4</sub>, 0.2 g; pH 5.0.

Inoculum for the molds was prepared by transfer-

<sup>1</sup> Present address: 2921 Glenwood, Billings, Mont. 59102.

## Production

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d in media (i) or (ii) and  
a clear zone in either media  
ask tests were made in the  
dia. (i) Malt-yeast extract  
ter): malt extract (Difco),  
, 3.0 g; peptone (Difco),  
, 10 g; pH 6.8. (ii) Corn-  
of (per liter): cornstarch  
30 g;  $MgSO_4 \cdot 7H_2O$ , 0.5 g;  
 $NaNO_3$ , 8.6 g;  $K_2HPO_4$ , 0.2

was prepared by transfer-

ring  $2 \times 10^7$  spores per ml from stock slants to 50 ml  
of cornstarch medium in 250-ml Erlenmeyer flasks  
which were incubated for 3 days at 28°C on a rotary  
shaker (270 rev/min). A 5-ml amount of 3-day cul-  
tures was used to inoculate 50 ml of fermentation  
medium. The molds were grown for 5 days on the  
rotary shaker. Bacteria and yeasts were tested for  
phytase production in the same manner, except that  
the inoculum was a 24-hr culture in malt-yeast extract  
broth. The cultures were grown for 3 days.

*Phytase activity measurement.* Phytase activity was  
determined by mixing 0.1 ml of suitably diluted cul-  
ture filtrate and 0.9 ml of 0.2 M acetate buffer, pH 4.5,  
containing 0.5 mg of calcium phytate. The mixture  
was incubated for 15 to 30 min at 37.5°C. Liberated  
orthophosphate was determined by the method of  
Fiske and Subbarow (4). One phytase activity unit  
was defined as the amount of enzyme that liberates 1  
mg of inorganic phosphate per hour.

## RESULTS AND DISCUSSION

*Survey of microorganisms for production of extracellular phytase.* More than 2,000 cultures  
were isolated from 68 soil samples in enrichment  
culture medium. Extracellular phytase activity  
was found mainly among the various molds  
tested. Extracellular phytase activity was ob-  
served with 28 of 82 *Aspergillus* spp., 1 of 58  
*Penicillium* spp., and 1 of 37 *Mucor* spp. None of  
the 13 *Rhizopus*, 4 *Cunninghamella*, 4 *Neurospora*,  
140 yeasts represented by 17 genera, or 56 bac-  
terial cultures represented by 18 genera produced  
extracellular phytase activity. It was demon-  
strated, however, that many of the above organ-  
isms possessed intracellular phytase activity. Of  
the 30 mold culture filtrates that attacked calcium  
phytate, 28 were from molds of the genus *Asper-  
gillus*. The most active group was *A. niger*  
(Table 1). Many other species of *Aspergillus*  
produced considerable amounts of intracellular  
phytase activity but negligible amounts of phytase  
activity in the culture filtrate. The amounts of  
extracellular phytase produced by various *A.  
niger* strains varied (Table 2). Many of the soil  
isolates which cleared the calcium phytate agar  
plates were *A. niger* strains. *A. ficuum* NRRL  
3135 was of special interest because it did not  
sporulate in most media and produced the highest  
phytase activity.

*Effect of phosphate on the production of extra-  
cellular phytase by *A. ficuum* NRRL 3135.* When  
simple sugars such as glucose and sucrose were  
used as a sole source of carbon, mycelial pellets  
were formed and low yields of phytase were  
observed. Certain types of cornmeal, however,  
gave dispersed mycelial growth and higher  
enzyme yield. The phytase yield in cornmeal  
medium, however, varied with the lot of corn-  
meal, depending on the phosphorus content of

TABLE 1. Survey of *Aspergillus* species for  
production of extracellular acid phytase

Species	No. of cultures tested	No. producing acid phytase
<i>A. fumigatus</i> .....	6	0
<i>A. flavus</i> .....	10	2
<i>A. flavipes</i> .....	3	0
<i>A. clavatus</i> .....	4	0
<i>A. glaucus</i> .....	7	0
<i>A. nidulans</i> .....	10	0
<i>A. ochraceus</i> .....	2	0
<i>A. versicolor</i> .....	3	1
<i>A. terreus</i> .....	2	1
<i>A. ustus</i> .....	2	0
<i>A. wentii</i> .....	3	0
<i>A. restrictus</i> .....	1	0
<i>A. niger</i> .....	22	21
<i>A. candidus</i> .....	2	0
<i>Aspergillus</i> species <sup>a</sup> .....	3	3

<sup>a</sup> Soil isolates.TABLE 2. Survey of *Aspergillus niger* varieties and  
strains for production of extracellular acid  
phytase

Varieties	Activity (units/ml)
<i>A. niger</i> ATCC 9142	2.1
<i>A. niger</i> ATCC 10864	0.8
<i>A. niger</i> van Tieghem	3.5
<i>A. niger</i> var. <i>cinnamomeum</i> NRRL 348	1.4
<i>A. niger</i> japonicus saito ATCC 1034	0.6
<i>A. niger</i> NRRL 372	1.0
<i>A. niger</i> NRRL 326	0.7
<i>A. niger</i> NRRL 330	0.8
<i>A. niger</i> NRRL 4361	0.7
<i>A. niger</i> NRRL 337	0.5
<i>A. awamori</i> ATCC 11382	2.3
<i>A. awamori</i> ATCC 11358	3.3
<i>A. sattoi</i> ATCC 11362	1.8
<i>A. carbonarius</i> NRRL 368	1.9
<i>A. carbonarius</i> PCC 104	1.5
<i>A. tubingensis</i> NRRL 4875	2.4
<i>A. ficuum</i> WB 4016	1.1
<i>A. ficuum</i> WB 320	1.0
<i>A. ficuum</i> WB 364	1.5
<i>A. ficuum</i> WB 4541	1.0
<i>A. ficuum</i> WB 4781	1.2
<i>A. ficuum</i> NRRL 3135 (soil isolate)	10.5
<i>A. niger</i> X (soil isolate)	5.0
<i>A. niger</i> K (soil isolate)	4.0

corns from various locations (Table 3). It became  
apparent that high total phosphorus content of  
corn grains suppressed phytase production by  
the mold. Feed grade cornstarch and dextrin were  
also used successfully by limiting the ortho-  
phosphate content of the medium. With limited

concentrations of phosphorus in the medium, mycelial growth of the mold was only suboptimal, but phytase production was maximal. The growth of mold increased with further increases in phosphate, but phytase synthesis decreased drastically when increasing amounts of phosphate were added to the medium (Fig. 1).

Inhibition of phytase synthesis by phosphate seems to be a general phenomenon, since it was observed in all species of molds and yeasts which were able to synthesize phytase.

TABLE 3. Effect of phosphate content of various corn grains on phytase production by *Aspergillus ficuum* NRRL 3135<sup>a</sup>

Sample no.	Total phosphate content (%)	Activity (units/ml)
15	0.10	6.4
14	0.17	6.0
5	0.24	1.5
8	0.28	0.52
1	0.29	0.52
9	0.30	0.40
6	0.31	0.48
7	0.32	0.40
4	0.44	0.16
3	0.69	0.15
2	0.70	0.15

<sup>a</sup> Basal medium consisted of (per liter): corn meal, 50 g; glucose, 30 g;  $MgSO_4 \cdot 7H_2O$ , 0.5 g; KCl, 0.5 g;  $FeSO_4$ , 0.1 g;  $NaNO_3$ , 8.6 g;  $K_2HPO_4$ , 0.2 g; pH 5.0.

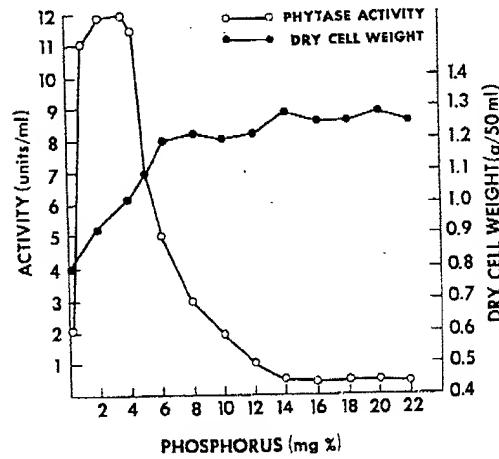


FIG. 1. Effect of phosphorus content on growth and production of phytase by *Aspergillus ficuum* NRRL 3135. Basal medium contained (per liter): glucose, 30 g; cornstarch, 80 g;  $MgSO_4 \cdot 7H_2O$ , 0.5 g; KCl, 0.5 g;  $FeSO_4$ , 0.1 g;  $NaNO_3$ , 8.6 g; phosphorus was added as  $K_2HPO_4$ ; pH 5.0.

TABLE 4. Effect of phosphorus and carbon content on phytase production by *Aspergillus ficuum* NRRL 3135<sup>a</sup>

Phos- phorus (mg/ 100 ml)	Cornstarch					
	2%		4%		8%	
	C/P <sup>b</sup>	Units/ ml	C/P <sup>b</sup>	Units/ ml	C/P <sup>b</sup>	Units/ ml
6	148	0	296	1.1	532	10.8
4	222	0	444	1.9	882	11.4
3	296	0.10	592	1.9	1,184	12.7
2	444	0.65	888	2.3	1,776	9.7
1	888	1.30	1,976	1.9	3,552	10.8
0.4	2,220	1.10	4,440	2.2	8,880	12.7

<sup>a</sup> Basal medium contained (per liter): glucose, 30 g;  $MgSO_4 \cdot 7H_2O$ , 0.5 g; KCl, 0.5 g;  $FeSO_4$ , 0.1 g;  $NaNO_3$ , 8.6 g; pH 5.0.

<sup>b</sup> Carbon to phosphorus ratio.

The induction of phytase by limiting inorganic phosphate in the medium, however, was dependent upon the total carbon present in the medium. The production of phytase in pure cornstarch synthetic medium increased with increasing ratios of carbon to phosphorus at given low levels of phosphorus in the medium (Table 4).

*A. ficuum* NRRL 3135 produced the most active phytase when the inorganic phosphate concentration was less than 0.004% (w/v) in a medium containing 8% (w/v) cornstarch. Since phytase is produced when the inorganic phosphate concentration becomes limiting, the organisms are provided with a means of obtaining inorganic phosphate from organic phosphates when this becomes necessary.

#### ACKNOWLEDGMENTS

We thank K. B. Raper for help with the identification of *A. ficuum* NRRL 3135 and H. E. Koffler for supplying many cultures from his culture collections.

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orus and carbon content  
by *Aspergillus ficuum*  
3135<sup>a</sup>

cornstarch

4%	8%	
	Units/ ml	C/P <sup>b</sup>
16	1.1	532 10.8
14	1.9	882 11.4
12	1.9	1,184 12.7
18	2.3	1,776 9.7
16	1.9	3,552 10.8
10	2.2	8,880 12.7

ied (per liter): glucose,  
g; KCl, 0.5 g; FeSO<sub>4</sub>,  
5.0.  
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present in the medium.  
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**EXHIBIT J**

# Production of phytate-hydrolysing enzyme by some fungi

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(Received 9 February 1983)

Eighty-four fungi from twenty five species have been examined for the production of extracellular enzymes capable of hydrolysing phytate (3-phytase, myo-inositol hexakisphosphate 3-phosphohydrolase, EC 3.1.3.8, and 6-phytase, myo-inositol hexakisphosphate 6-phosphohydrolase, EC 3.1.3.26) when grown in: (1) rapeseed meal (RSM); (2) a semisynthetic medium containing phytate as the sole phosphorus source (PSM); (3) potato dextrose broth (PDB). Although 58 active strains showed substantial activity, results in either of the media were of no value in indicating activity in RSM. There was no relationship between the ability of a fungus to hydrolyse phytate and its taxonomic position. *Aspergillus ficuum* NRRL 3135 had the greatest activity in the synthetic medium, and was relatively active in RSM. The extracellular enzyme had maximum activity after 10 days growth in PSM and had a temperature optimum of 55°C. Two pH optima were noted at pH 2.0 and 5.5. Inorganic phosphate inhibited enzyme production; ammonia ions were a better nitrogen source than nitrate or urea.

**Keywords:** Rapeseed meal; phytate; phytate hydrolysing enzyme; *Aspergillus ficuum*

## Introduction

Salts of phytic acid (*myo*-inositol hexakisdihydrogen phosphate) are found in many plant tissues and related food products.<sup>1,2</sup> Phytate constitutes approximately 1–2% by weight of cereals and oilseeds<sup>3</sup> and phytate phosphorus accounts for between 60 and 90% of the total phosphorus present in these seeds;<sup>4</sup> it is considered to act either as a reserve of phosphorus or *myo*-inositol or in maintaining a phosphorus balance.<sup>5,6</sup> The insoluble phytates are closely associated with proteins, especially in oilseeds,<sup>7</sup> and reduce the bioavailability<sup>4,8</sup> of basic amino acid groups in the proteins. Phytic acid is also a strong chelating agent and readily binds covalent metal ions, rendering them insoluble and thus unavailable for absorption.<sup>3,9</sup> The nutritional consequences of phytic acid interactions with protein and minerals are well documented<sup>3,4,9</sup> and methods for its removal from foods of plant origin are desirable. Most research has concentrated on the removal of phytate from soyabean and related products, because of their importance as sources of edible oil and as a protein source for human and animal consumption.<sup>3,10</sup>

Recently, increased interest has been given to rapeseed, the most suitable oil seed for temperate climates and consequently a source of protein.<sup>11–14</sup> However, rapeseed meal and protein isolates possess even higher phytic acid levels than many plant foods<sup>3</sup> and animal feeding trials have highlighted the problems caused by phytate.<sup>15–17</sup>

Methods have been developed for the removal of phytates from soyabean meal<sup>4</sup> although none has yet achieved economic feasibility. One possibility is the use of phytase enzymes (3-phytase, *myo*-inositol hexakisphosphate 3-phosphohydrolase, EC 3.1.3.8, and 6-phytase, *myo*-inositol hexakisphosphate 6-phosphohydrolase, EC 3.1.3.26) for the

hydrolysis of the phytic acid into phosphoric acid and *myo*-inositol. Several workers have studied the properties of phytase enzymes, including those isolated from microorganisms.<sup>18–20</sup> Indeed, phytate reduction is a characteristic of fermentations such as those carried out by bakers' yeast<sup>21–23</sup> and in the production of soyabean tempeh.<sup>24</sup>

The work in this laboratory was primarily concerned with the removal of phytate from rapeseed meal by using phytase. This paper reports a survey of microorganisms for the ability to produce a suitable extracellular phytase, some characteristic properties of a partially purified mould phytase and a comparison of this enzyme with wheat 6-phytase.

## Materials and methods

### Organisms

Cultures were maintained on Difco-Bacto yeast malt agar (YM) slopes, except for strains of *Botrytis cinerea* and *Cladosporium* spp., which were kept on Difco-Bacto potato dextrose agar (PDA). To increase spore production, species of *Aspergillus* were grown on Czapek-Dox agar.

### Screening programme

The optimum moisture content for the production of phytase by growing cultures in rapeseed meal was determined with *Rhizopus oligosporus*, a mould used in producing tempeh in Indonesia<sup>25</sup> and already shown to reduce the level of phytate during fermentation.<sup>24</sup>

Spores of *R. oligosporus* were harvested from YM slopes, previously incubated for 7 days at 25°C, using 9 ml 0.1% Tween 80. The suspension was filtered through two layers of sterile muslin, centrifuged at

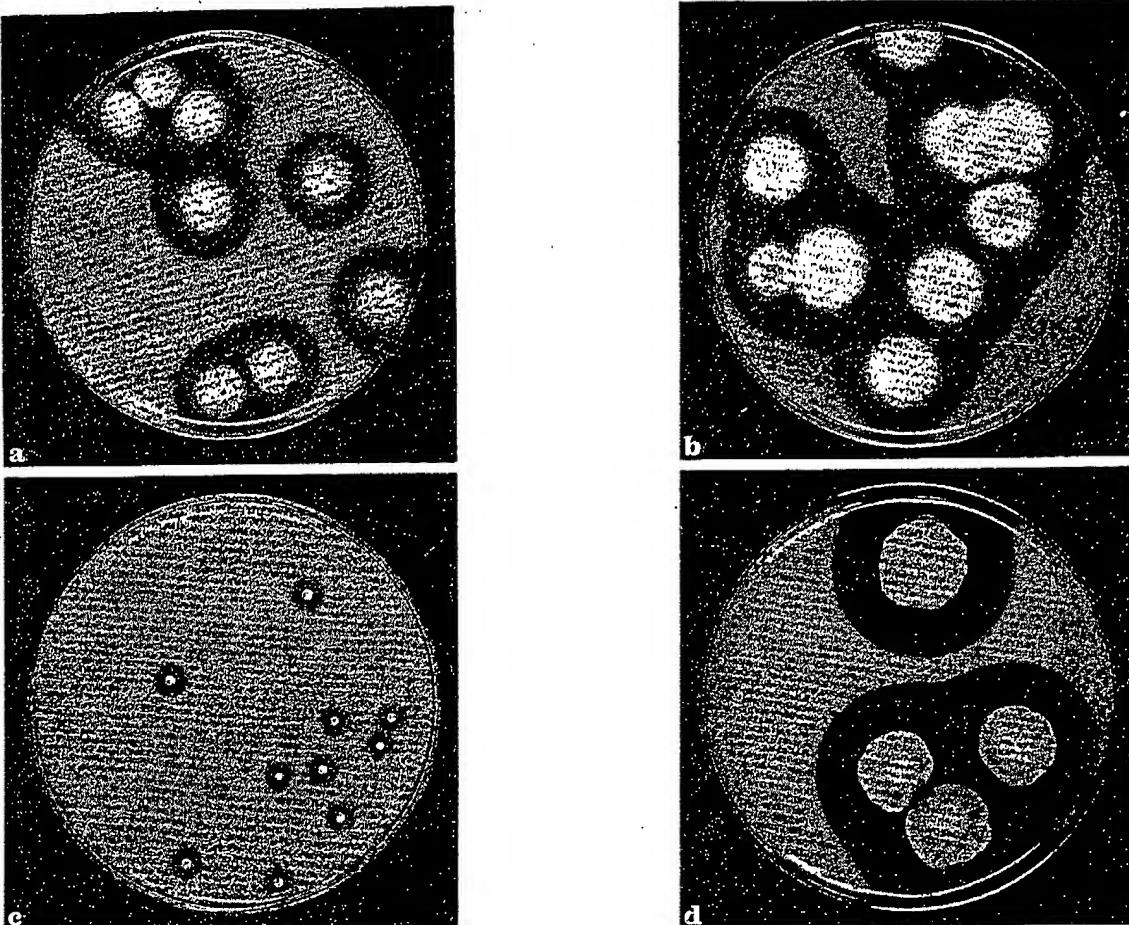


Figure 1 Plates showing growth of (a) *Aspergillus niger* (b) *A. ficuum* (c) *Saccharomyces cerevisiae* and (d) *Geotrichum candidum* on phytase screening agar

4000 rev/min for 15 min, the supernatant decanted and the spores resuspended in sterile glass distilled water (GDW). The spore concentration was adjusted to  $2 \times 10^6 \text{ ml}^{-1}$ .

Duplicate samples (50 g) of rapeseed meal were weighed into 250 ml conical flasks and inoculated with 10 ml of spore suspension, giving a moisture content of ~25%. Sterile GDW was added to further duplicate samples, giving a range of moisture contents between 30 and 90%. The flasks were incubated for 3 days at 25°C on an orbital shaker (LH Engineering Co., England). After incubation, the cultures were lyophilized before estimating residual phytate in the treated meal using a modification of the method described by Uppstrom and Svenson.<sup>26</sup>

Triplicate samples (1 g) of lyophilized meal were extracted with 20 ml 1 M hydrochloric acid for 1 h at 25°C. After centrifugation, 6 ml of the supernatant was pipetted into a 25 ml volumetric flask followed by 4 ml 2.8 M sodium acetate buffer, pH 8.5, containing 0.1 M magnesium sulphate and, finally, 50 mg wheat 6-phytase (Sigma Chemical Co. Ltd) dissolved in 5 ml demineralized water, before making up to volume with water. Background phosphate was measured using 1 ml of this solution and the remainder was incubated for 24 h at 37°C, when the phosphate was measured in a second aliquot (1 ml). Phosphate was measured using the method of Allen<sup>27</sup> by reacting the sample with ammonium molybdate, after acidification, and measuring the resultant blue colour on a Pye-Unicam SP600 spectrophotometer at 780 nm. The

calibration curve was plotted from  $\text{KH}_2\text{PO}_4$  solutions and phytate phosphorus estimated as the increase arising from enzyme hydrolysis.

Initial levels of phytate were estimated on untreated samples of rapeseed meal:

Spores or cells of a range of moulds and yeasts were grown and harvested as described for *R. oligosporus*. The final spore/cell suspension was adjusted to  $\sim 10^7 \text{ ml}^{-1}$  and used to inoculate the following media.

(a) Rapeseed meal. Samples were set up as described for *R. oligosporus*, with a final moisture content of 90%. Incubation and phytate estimation was carried out as described previously.

(b) Phytase screening medium (PSM) agar. This was a synthetic medium of the following composition ( $\text{g l}^{-1}$ ): D-glucose, 15.0; calcium phytate, 5.0;  $\text{NH}_4\text{NO}_3$ , 5.0;  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ , 0.5; KCl, 0.5;  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ , 0.01;  $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$ , 0.01; made to volume with distilled water and solidified with Difco-Bacto New Zealand agar. The pH was adjusted to 5.5 using 1 M HCl before autoclaving at 121°C for 20 min. Duplicate plates were inoculated with 0.1 ml of the spore/cell suspension, adjusted to contain  $10^2 \text{ spores ml}^{-1}$ . The spread plates were then incubated at 25°C for 4 days, after which time growth and clearance of the agar gave a visual indication of extracellular phytase production (see Figure 1).

(c) PSM broth. Samples (100 ml) of PSM broth were inoculated with 0.1 ml of a suspension containing  $10^7 \text{ spores cell ml}^{-1}$  and incubated for 4 days at 25°C on an orbital

shaker. The culture was then filtered using Whatman No. 1 filter paper and the filtrate centrifuged at 12 000 rev/min at 5°C for 30 min. The supernatants were then stored at -20°C prior to assaying phytase activity.

Into test tubes were pipetted 0.5 ml of 0.2 M sodium acetate buffer (pH 4.4), 0.5 ml sodium phytate in 0.2 M sodium acetate buffer followed by 1 ml of culture filtrate, giving a final pH of 5.5. Duplicate samples were incubated in a water bath at 40°C for 0 and 45 min, before the reaction was stopped by adding 2 ml 15% TCA. Ortho-phosphate in the reaction mixture was estimated according to Allen<sup>27</sup> and phytase activity measured as the amount of phosphate released during the incubation time. One unit of phytase activity was defined as the amount of enzyme capable of releasing one mole of inorganic phosphorus in one minute under the defined reaction conditions.

(d) Difco-Bacto Potato dextrose broth (PDB). Inoculation, incubation, recovery and phytase assay of culture filtrates in PDB was carried out as for PSM broth.

#### Characterization of the phytase of *Aspergillus ficuum*

Flasks containing 100 ml PSM broth were inoculated with 10<sup>6</sup> spores of *A. ficuum* NRRL 3135 as described above, and incubated on an orbital shaker at 25°C. Duplicate cultures were harvested daily up to 16 days, the filtrate purified and assayed for phytase activity as described.

The temperature profile of phytase activity in PSM culture filtrates of *A. ficuum* was determined by assays of triplicate samples as described previously over a range of 20°C to 70°C. Blanks and tests were both performed at each temperature after equilibration of all components prior to the reaction.

The pH profile of phytase activity was determined at 40°C. To achieve a wide pH range, the sodium phytate concentration was reduced to 10 mg ml<sup>-1</sup> of relevant buffer. Buffers used were: Sorensens glycine I (pH 2.15–3.05); Kolthoffs borax–succinate (pH 3.87–7.14) and Sorensens citrate II (pH 7.25–8.0).<sup>28</sup> The assay was conducted using duplicate samples as described, and the pH of the final reaction mixture was recorded.

The effect of inorganic phosphate on the development of phytase activity during growth was tested by incubating duplicate samples of *A. ficuum* at 25°C for 4 days in PSM broth containing different concentrations of KH<sub>2</sub>PO<sub>4</sub> as the only source of inorganic phosphate (Table 4).

The effect of variation of the nitrogen source on enzyme production was tested by altering the nitrogenous compounds present in the basic PSM broth (Table 5). The final level of nitrogen in each medium was the same as in the basic PSM broth as described earlier. The phytase assay was carried out as already described after adjustment of the pH of the culture filtrates to 5.5 using 0.1 M NaOH or 1 M HCl as necessary.

#### Comparison of activity of wheat 6-phytase and *A. ficuum* phytase on RSM

Six litres of PSM was inoculated with 5 ml of a spore suspension of *A. ficuum* containing 10<sup>7</sup> spores ml<sup>-1</sup>. The culture was incubated at 25°C on an orbital shaker (250 rev/min) for 10 days. It was then filtered through Whatman No. 1 filter paper and the supernatant centrifuged at 12 000 rev/min for 30 min at 4°C. The 4900 ml of culture filtrate obtained was lyophilized (Edward Shelf Model EG6 (S)) and the resultant preparation was suspended

in 40 ml of glass-distilled water. This was assayed and found to have an activity of 0.634 U ml<sup>-1</sup>.

This phytase was then compared with a commercial preparation of wheat 6-phytase (Sigma Chemical Co.). The wheat 6-phytase had an activity of 0.018 U mg<sup>-1</sup> solid.

To 5 g of meal was added 500 mg of one of the phytase preparations and 40 ml of glass-distilled water (equivalent moisture content 90%). Duplicate samples were incubated in 100 ml conical flasks at 40°C in a shaking incubator (New Brunswick Ltd). The conditions of incubation varied as follows: (a) 24 h; (b) 48 h; (c) after 24 h another 500 mg of enzyme was added and incubated for a further 24 h; (d) as for (c) except 5 g meal was added rather than the enzyme.

After incubation these samples were then extracted and assayed as described previously.

#### Results and discussion

The optimum moisture content for phytase activity, as shown by the reduction of phytate, in rapeseed meal incubated for 3 days at 25°C after inoculation with spores of *R. oligosporus* was 80% (Table 1). Reinhold<sup>29</sup> also reported increased removal of phytate from bread doughs incubated with *Saccharomyces cerevisiae* at high moisture contents. Glass and Geddes<sup>30</sup> found that phytase activity was not detectable in dry dormant wheat grains whilst activity increased with rising moisture content during storage.

The reduction of phytate in rapeseed meal achieved by a range of fungi and yeasts, after incubation under similar conditions, varied between 10 and 80%. A similar degree of variation in the reduction of phytate was observed for different strains of a given species; data for *Aspergillus niger* are shown in Table 2. Extracellular phytase activity was detected in 33 out of 84 strains tested in PSM and in 37 strains in PDB (Table 3). All strains which showed enzyme

Table 1 Reduction of phytate in rapeseed meal inoculated with conidia of *Rhizopus oligosporus* and incubated for 3 days at 30°C

Moisture content (%)	Phytate content of meal (mg g <sup>-1</sup> )	% reduction
25	36.0	18
30	37.2	15
40	38.1	14
50	36.8	16
60	35.0	20
70	31.2	29
80	16.0	64
90	20.5	54

Table 2 Effect of culture of various strains of *A. niger* on the phytate content of rapeseed meal

Strain	Residual phytate in meal (mg g <sup>-1</sup> )	Phytate reduction (% w/w)
L25	7.7	37.9
CS180	8.2	34.3
L9	8.4	32.3
CS14	4.2	66.0
UD314	9.7	21.8
L10	10.9	12.2
L26	10.9	12.1
CS14	3.8	69.4

Table 3 Survey of microorganisms for phytate hydrolysing activity in culture filtrates

	Strains exhibiting activity in PSM		Strains exhibiting activity in PDB	
	Positive	Negative	Positive	Negative
<i>Aspergillus niger</i>	0	7	3	4
<i>A. ficum</i>	1	0	1	0
<i>A. petrakii</i>	0	2	0	2
<i>A. candidus</i>	3	2	0	5
<i>A. flavus</i>	0	6	4	2
<i>A. wentii</i>	0	1	1	0
<i>A. versicolor</i>	2	3	1	4
<i>A. sydowi</i>	3	0	3	0
<i>A. repens</i>	2	2	3	1
<i>A. chevalieri</i>	0	2	1	1
<i>A. amstelodami</i>	3	2	3	2
<i>Saccharomyces cerevisiae</i>	4	8	6	6
<i>S. uvarum</i>	0	1	0	1
<i>Rhizopus oryzae</i>	2	3	2	3
<i>R. oligosporus</i>	1	0	0	1
<i>R. stolonifer</i>	2	2	2	2
<i>R. arrhizus</i>	0	1	0	1
<i>Mucor racemosus</i>	3	2	4	1
<i>M. piriformis</i>	4	0	2	2
<i>Geotrichum candidum</i>	1	0	0	1
<i>Botrytis cinerea</i>	2	3	1	4
<i>Cladosporium cladosporoides</i>	0	1	0	1
<i>Rhodotorulla graminis</i>	0	1	0	1
<i>A. oryzae</i>	0	2	0	2

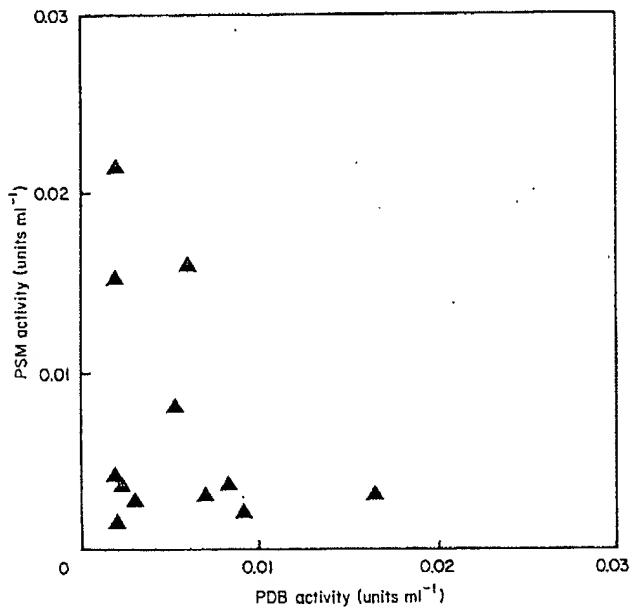


Figure 2 Extracellular phytase activity of various strains of moulds and yeasts when grown in PSM and PDB

activity in PSM broth cultures were also seen to produce zones of clearance in advance of mycelial growth on PSM agar plates (Figure 1). Twelve strains gave phytase activity in both PSM filtrates and PDB, indicating that the enzyme was constitutive, whilst 21 strains showed phytase activity only in PSM broth indicating that the enzyme is induced by the presence of the substrate. However, 25 strains tested showed activity only in PDB filtrates and not in PSM, which may have been an effect of substrate inhibition. The total number of active strains was 58; 26 strains showed no activity in the culture filtrates.

There was little correlation between phytate hydrolysing activity in the two media (Figure 2). Moreover, there was little correlation between the ability to reduce phytate in RSM and to produce an extracellular enzyme in PSM or PDB (Figures 3 and 4).

The *Aspergillus* species appeared to be the best source of extracellular phytase enzymes, whilst *Aspergillus ficuum*

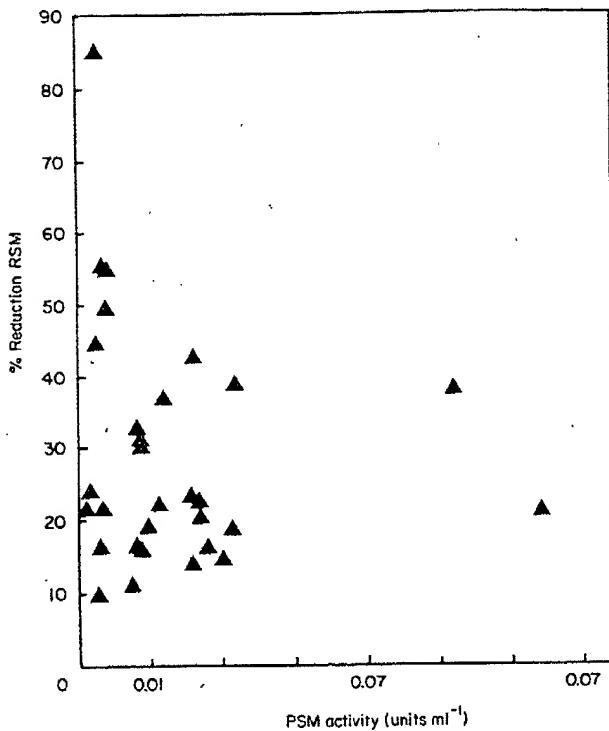


Figure 3 Reduction of phytate content of RSM compared with extracellular phytase activity of moulds and yeasts when grown in PSM

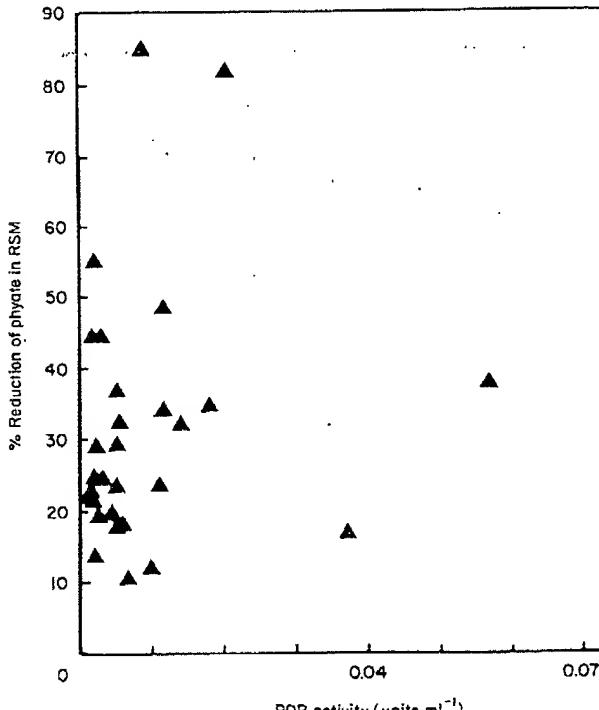


Figure 4 Reduction of phytate content of RSM by strains of moulds and yeasts when compared to their extracellular phytase activity in PDB

provided the most active culture filtrates. Shieh and Ware<sup>18</sup> also found that *Aspergillus* species commonly possessed phytase enzymes and that the most active phytase extracts were produced by *Aspergillus ficuum*. Both inter- and intraspecies variation was observed.

#### Properties of extracellular phytase from *Aspergillus ficuum*

The highest extracellular phytase activity in PSM culture filtrates of *A. ficuum* was recorded after 10 days incubation at 25°C (Figure 5), when the activity of the culture filtrate was approximately 6 times greater than at 4 days. Skowronski<sup>31</sup> found that phytase activity in culture filtrates of the closely related fungus *A. niger* reached a peak after 11 to 12 days. The situation varies with species. Strains of *Geotrichum candidum* showed optimum activity at 4 days under the same conditions; after this time, activity was reduced by >60% (data not shown).

The increase in activity with time recorded in culture filtrates of *A. ficuum* could have been a result of autolysis rather than induction, as the enzyme appears to be constitutive. The mycelial mat disintegrated after 11–12 days, indicating that autolysis of the mycelium occurred and could result in leakage of intracellular enzyme into the medium. Skowronski<sup>31</sup> reached a similar conclusion by excluding substrate induction by components of the culture medium.

The temperature optimum for phytase activity was 55°C; the activity at 40°C, used for the standard activity assay, was 40% of that at 55°C (Figure 6). Skowronski<sup>32</sup> reported a similar optimum (53°C) for the closely related species *A. niger*, while reports for *A. terreus* give a range between 60 and 70°C.<sup>33,34</sup> All three species are considered to be very closely related and all have been classified as *A. niger* in the past.<sup>35</sup> Similarly high optimum temperatures for

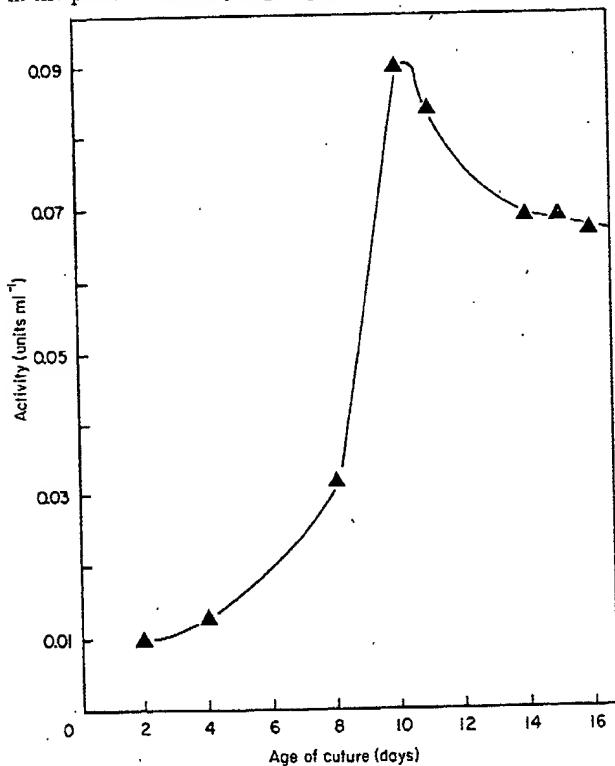


Figure 5 Time course of the production of phytate hydrolysing enzyme in the culture filtrate of *Aspergillus ficuum* NRRL 3135 grown in PSM

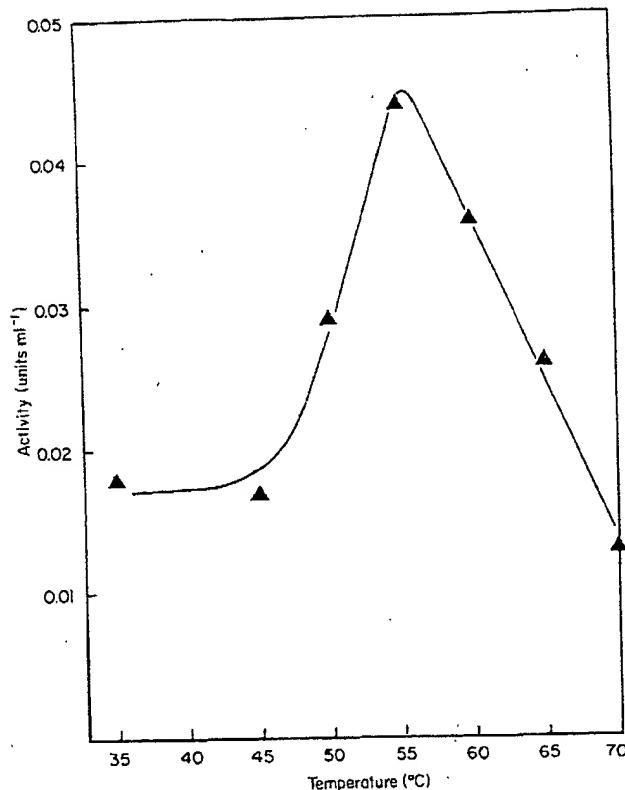


Figure 6 Temperature profile of the enzymes capable of hydrolysing phytate in the culture filtrate of *Aspergillus ficuum* NRRL 3135 grown in PSM

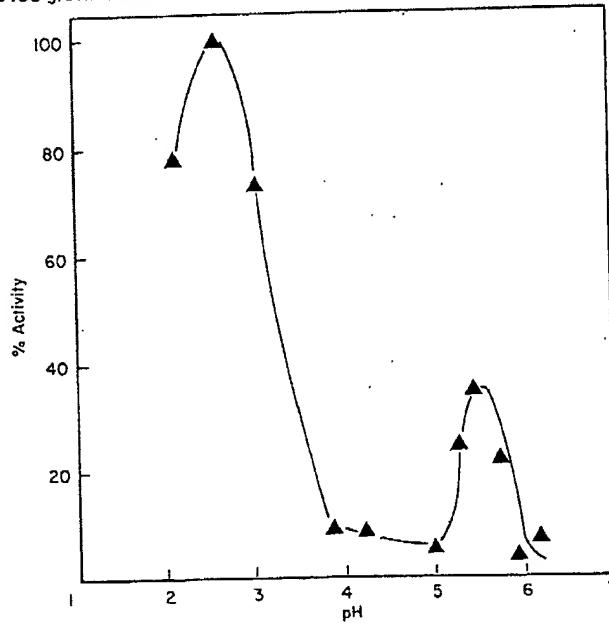


Figure 7 pH profile of the culture filtrate of *Aspergillus ficuum* NRRL 3135 with respect to phytate hydrolysis  
phytase activity have been reported for the enzyme from other microorganisms<sup>36</sup> and from plants.<sup>37</sup>

Phytase activity showed two pH optima, one at 2.0 and a second less active peak at 5.5 (Figure 7). Previous reports have also shown phytase enzymes of *A. ficuum* and related *Aspergillus* species to have two pH optima.<sup>19,31,32,38</sup> Shieh *et al.*<sup>38</sup> separated the two peaks by column chromatography and termed the pH 2.0 fraction as a non-specific acid phosphatase and the pH 5.5 fraction as phytase, which still showed activity at pH 2.0, although at a low level. Skowronski<sup>31</sup> showed that the peaks represented two

**Table 4** Effect of various concentrations of inorganic phosphate on extracellular phytase activity of *A. ficuum* in PSM

Inorganic phosphate concentration (mg dl <sup>-1</sup> )	Activity (units ml <sup>-1</sup> )
2	0.24
5	0.20
10	0.12
15	0.05
20	0.02
25	0
50	0

**Table 5** Effect of various nitrogen sources on extracellular phytase production in *A. ficuum*

Nitrogen source	Activity (units ml <sup>-1</sup> )	Relative activity (%) PSM
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	0.026	173.3
Urea	0.004	26.7
NH <sub>4</sub> H <sub>2</sub> PO <sub>4</sub>	0.026	173.3
NaNO <sub>3</sub>	0.012	80.0
KNO <sub>3</sub>	0.014	93.4
NH <sub>4</sub> NO <sub>3</sub> (standard PSM)	0.015	100

**Table 6** Comparison of reduction of phytate in RSM by wheat 6-phytase and *A. ficuum* phytase under different conditions (500 mg enzyme + 40 ml GDW + 5 g meal incubated at 40°C)

Conditions	% reduction
Wheat 6-phytase	
24 h	73.4
48 h	80.3
24 h + 500 mg enzyme	87.0
24 h + 500 mg meal	73.0
<i>A. ficuum</i> phytase	
24 h	65.2
48 h	65.9
24 h + 500 mg enzyme	84.0
24 h + 500 mg meal	80.2

enzymes as they exhibited markedly different heat stability properties. In contrast, Irving and Cosgrove<sup>19</sup> found it impossible to discern whether the two peaks represented one or two enzymes as they failed to separate the two active centres either by gel electrophoresis or the 'visualization method'.

Shieh *et al.*<sup>38</sup> showed that increased levels of inorganic phosphorus in the growth medium suppressed synthesis of both 'enzymes' although the ratio of the pH 2.0 to the pH 5.0 peaks was reversed, and the phytase enzyme became the most active enzyme produced. This was confirmed by our experiments in which different levels of inorganic phosphorus were added to PSM broth, which contains negligible inorganic phosphorus. Inhibition of enzyme production occurred above 0.2 mg ml<sup>-1</sup> of inorganic phosphorus, as can be seen from the results in *Table 4*.

Phytate production is also influenced by nitrogen source, with ammonium ions being markedly superior to nitrate and urea (*Table 5*). We found that urea supported little growth. Ammonium salts were also found to be the best nitrogen source in the medium for subsequent phytase production by *A. terreus* cultures.<sup>34</sup>

It was of interest to compare the activity towards phytate in RSM of phytate degrading enzymes from *A. ficuum* and from wheat which is commercially available. Both enzymes decreased the phytic acid content to a substantial degree, with the preparation from wheat being somewhat more active. Residual phytate was present in

RSM even after prolonged incubation. This result does not reflect loss of activity by the enzyme for the addition to the incubation mixture containing enzyme from either source of more RSM led to further removal of phytate (*Table 6*). It may be that some proportion of the phytate in RSM is inaccessible to the enzyme, perhaps by its occlusion within cells or by cellular constituents. The addition of further enzyme to meal in which phytate had already been substantially degraded by earlier enzyme addition did not result in complete breakdown of phytate (data not shown).

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**EXHIBIT K**

**IN THE MATTER OF THE APPLICATION OF PETER S. CARLETON**

**Appeal No. 78-634.**

**United States Court of Customs And Patent Appeals**

**599 F.2d 1021; 1979 CCPA LEXIS 241; 202 U.S.P.Q. (BNA) 165**

**June 7, 1979, Decided**

**PRIOR HISTORY: [\*\*1]**

Serial No. 563,464.

**CASE SUMMARY:**

**PROCEDURAL POSTURE:** Appellant patent applicant sought review of decision of the Patent and Trademark Office Board of Appeals, which affirmed the patent examiner's rejection of appellant's patent claims under 35 U.S.C.S. § 103 for a chemical process in the production of hydroquinone.

**OVERVIEW:** Appellant, a patent applicant for chemical process producing hydroquinone, sought review of the Board's decision affirming the patent examiner's rejection of appellant's patent claims under 35 U.S.C.S. § 103. The Board held that cited references made out a strong case of prima facie obviousness against appellant. The starting material of the claimed process was encompassed in a prior art's generic starting materials, and an oxidation agent in the claimed process was stated in a prior art to be the preferred oxidizing agent. Appellant rebutted the rejection with affidavits disclosing test results that showed substantially lower yields of hydroquinone obtained in using appellant's starting material than the yield obtained with the prior art's starting material. It would not have been obvious to use an oxidizing agent in the claimed process together with the starting material in the claimed process. The court reversed, holding that appellant's affidavits,

together with the other evidence, sufficed to rebut the prima facie case of obviousness.

**OUTCOME:** The court reversed the Board's decision.

**LexisNexis(R) Headnotes**

*Patent Law > Nonobviousness > Evidence & Procedure  
> Prima Facie Obviousness*

*Patent Law > Nonobviousness > Evidence & Procedure  
> Presumptions & Proof*

*Patent Law > Inequitable Conduct > General Overview*

[HN1] In a 35 U.S.C.S. § 103 case, the burden of proof is on the Patent and Trademark Office to establish a prima facie case of obviousness, and, once this has been accomplished, the burden of going forward with evidence to rebut that prima facie case is shifted to the applicant.

*Patent Law > Nonobviousness > Evidence & Procedure  
> Prima Facie Obviousness*

*Patent Law > Jurisdiction & Review > Subject Matter  
Jurisdiction > Appeals*

*Patent Law > Infringement Actions > Burdens of Proof*

[HN2] Whether a prima facie case under 35 U.S.C.S. § 103 is "strong" or "weak" is not material. If the patent applicant presents rebuttal evidence, the decisionmaker must consider all of the evidence of record, both that supporting and that rebutting the prima facie case, in determining whether the subject matter as a whole would have been obvious.

599 F.2d 1021, \*; 1979 CCPA LEXIS 241, \*\*;  
202 U.S.P.Q. (BNA) 165

**Patent Law > Jurisdiction & Review > Subject Matter  
Jurisdiction > Appeals**

**Patent Law > Jurisdiction & Review > Standards of Review > General Overview**

**Patent Law > Nonobviousness > General Overview**

[HN3] The issue on appeal of a finding of obviousness under 35 U.S.C.S. § 103, is whether the decision of the Patent and Trademark Board of Appeals is clearly erroneous.

**Patent Law > Nonobviousness > Evidence & Procedure  
> Fact & Law Issues**

**Patent Law > Jurisdiction & Review > Subject Matter  
Jurisdiction > Appeals**

**Patent Law > U.S. Patent & Trademark Office  
Proceedings > Appeals**

[HN4] Obviousness under 35 U.S.C.S. § 103, is a legal conclusion based on factual evidence and not a factual determination. Therefore, the proper issue before a reviewing court is whether the Patent and Trademark Board of Appeals erred, as a matter of law, in holding that the claims were properly rejected under 35 U.S.C.S. § 103. In deciding this issue, the court will make an independent determination as to the legal conclusions and inferences which should be drawn from the findings of fact.

**Patent Law > U.S. Patent & Trademark Office  
Proceedings > Appeals**

**Patent Law > Nonobviousness > Evidence & Procedure  
> Fact & Law Issues**

**Patent Law > Jurisdiction & Review > Subject Matter  
Jurisdiction > Appeals**

[HNS5] In deciding whether the Trademark and Patent Office Board of Appeals erred, as a matter of law, in holding that claims were properly rejected under 35 U.S.C.S. § 103, by the Patent and Trademark Office examiner, the court must make an independent determination as to the legal conclusions and inferences which should be drawn from the findings of fact.

**Patent Law > Nonobviousness > Evidence & Procedure  
> Prima Facie Obviousness**

**Patent Law > Jurisdiction & Review > Subject Matter  
Jurisdiction > Appeals**

**Patent Law > U.S. Patent & Trademark Office  
Proceedings > Appeals**

[HN6] Prima facie obviousness is a legal conclusion, not a fact. Facts established by rebuttal evidence must be evaluated along with the facts on which the earlier conclusion was reached, not against the conclusion itself. Though the tribunal must begin anew, a final finding of obviousness may of course be reached, but such finding will rest upon evaluation of all facts in evidence,

uninfluenced by any earlier conclusion reached by an earlier board upon a different record.

#### COUNSEL:

Roman Saliwanchik, attorney of record, for appellant, Denis A. Firth, John Kekich, of counsel.

Joseph F. Nakamura for the Commissioner of Patents, Fred W. Sherling, of counsel.

#### OPINIONBY:

MILLER

#### OPINION: [\*1021]

Before MARKEY, Chief Judge, RICH, BALDWIN, and MILLER, Associate Judges, and KUNZIG, \* Judge.

\* The Honorable Robert L. Kunzig, Judge, United States Court of Claims, sitting by designation.

MILLER, Judge.

This is an appeal from the decision of the Patent and Trademark Office ("PTO") Board of Appeals ("board") sustaining the rejection under 35 USC 103 of claims 9-13 and 15-16. We reverse.

#### BACKGROUND

##### The Invention

Appellant's application n1/ discloses a process for the substantially quantitative production of hydroquinone. Claims 9-10 and 15 n2/ are directed to the reaction of p-isopropenylphenol and hydrogen peroxide in an inert solvent such as glacial acetic acid and in the presence of a catalytic amount of a strong mineral acid to produce hydroquinone and acetone (see reaction step (3) [\*1022] below). Claims 11-13 and 16 n3/ are directed to the semicontinuous production of hydroquinone through the production [\*\*2] of p-isopropenylphenol from phenol and acetone, according to the following reaction sequence: [See illustration in original.]

n1 Serial No. 563,464, filed March 31, 1975, for "Process."

n2/ Claim 9, which is illustrative of this set of claims, reads:

9. A process which comprises reacting p-isopropenylphenol with an at least equimolar amount of hydrogen peroxide in the presence of

599 F.2d 1021, \*; 1979 CCPA LEXIS 241, \*\*;  
202 U.S.P.Q. (BNA) 165

glacial acetic acid and a catalytic amount of a strong acid selected from the group consisting of sulfuric, phosphoric, p-toluenesulfonic, benzenesulfonic, methanesulfonic and ethanesulfonic acids, said reaction being carried out at a temperature not greater than 80 degree C whereby there is obtained hydroquinone and acetone.

n3/ Claim 12, which is illustrative of this set of claims, reads:

12. A semicontinuous process for the conversion of phenol to hydroquinone which comprises condensing phenol and acetone in the presence of acid to obtain Bisphenol A, subjecting said Bisphenol A to alkaline hydrolysis to yield a mixture of phenol and p-isopropenylphenol subjecting said mixture of phenol and p-isopropenylphenol, without separation, to reaction with at least an equimolar amount, based on p-isopropenylphenol, of hydrogen peroxide in the presence of an inert solvent and a catalytic amount of a strong acid selected from the group consisting of sulfuric, phosphoric, p-toluenesulfonic, benzenesulfonic, methanesulfonic and ethanesulfonic acids said reaction being carried out at a temperature not greater than 80 degree C, to obtain a mixture of hydroquinone, phenol, and acetone, recovering the hydroquinone therefrom, and recovering the phenol and acetone generated as by-products for re-use as starting materials in a subsequent cycle of the above steps. [\*\*3]

#### The Rejections and Appellant's Response

The examiner rejected claims 9-10 and 15 as unpatentable over a patent to Robert H. Saunders ("Saunders"), n4/ which discloses a process for the preparation of various phenols from Alpha, Bata-unsaturated alkyl-substituted aryl n5/ compounds. Hydroquinone is a phenol. n6/ His reaction occurs in a liquid solvent, such as acetic acid, with a strong acid catalyst and, preferably, with "low cost" hydrogen peroxide as the oxidizing agent. In example 2, Alpha-methylstyrene, which the examiner said is the closest in structure to the starting material of appellant's claimed invention (p-isopropenylphenol), is reacted with t-butylhydroperoxide to produce phenol in about an 80% yield: [See illustration in original].

Although the production of hydroquinone as such is mentioned by Saunders, the only suggested process begins with , , '-tetramethyl-p-xylylene dialcohol as the starting material. n7

n4 U.S. Patent No. 2,44,014, issued June 30, 1953, for "Phenol Production."

n5 The patent defines the term "aryl" to include the "phenyl" radical.

n6 A phenol is a benzene ring to which a hydroxyl group (-OH) has been attached: [See illustration in original].

Other substituents (or groups) may be attached to the benzene ring at various points around the ring. Hydroquinone is within the class of phenols because it has an additional hydroxyl group attached to the benzene ring: [See illustration in original].

n7. The process would be represented as follows: [See illustration in original]. [\*\*4]

The examiner's rejection of claims 11-13 and 16 was based on Saunders in view of a patent to John L. Jones ("Jones"). n8 Jones was cited for the disclosure of a method for the preparation of phenols having unsaturated substituents (such as p-isopropenylphenol--the starting material of claims 9-10 and 15) via a two-step reaction. In the first step, a phenol is condensed in the presence of an acid catalyst with a ketone to produce an intermediate "condensation product," which is then treated with a strong alkali metal base to neutralize the acidic catalyst. The mixture undergoes pyrolysis producing the desired phenolic compound (with an unsubstituted side chain), [\*1023] phenol, and a polymeric residue. On appeal, appellant has not argued that the first two steps of his reaction sequence, in which p-isopropenylphenol is produced, would not have been obvious in light of the PTO's citation to Jones. n8

n8 U. S. patent No. 2,497,503, issued February 14, 1950, for "Preparation of Substituted Phenols."

In response to the rejections, appellant submitted several affidavits (including two by him) under 37 CFR 1.132. One by Sheng-Hong A. Dai described two tests. In the first test [\*\*5] ("Dai I"), the procedure of example 2 of the Saunders patent was followed "exactly" n9 (the starting material being -methylstyrene), except the hydrogen peroxide (instead of t-butylhydroperoxide) was used as the oxidizing agent. A yield of only 15.8% phenol was reported; the major product was believed to be dimers of the -methylstyrene. n10 In the second test ("Dai II"), the "exact" reaction conditions of example 2 of Saunders were followed except that p-isopropenylphenol (the starting material of appellant's process) was used. A yield of only 47% hydroquinone was obtained.

599 F.2d 1021, \*; 1979 CCPA LEXIS 241, \*\*;  
202 U.S.P.Q. (BNA) 165

n9 A miscalculation in the original Dai affidavit was corrected before the board's opinion on reconsideration, thereby alleviating the board's concern in its original opinion that an excessive amount of sulfuric acid was used in Dai I.

n10 Although conditions were somewhat varied from those of the Saunders reference, the first affidavit of appellant Carleton ("Carleton I") reports the result of a similar experiment. No phenol was detected, and the major products were a dimer of -methylstyrene and 1,1,3-trimethyl-3-phenylindan.

Appellant also directed the examiner's attention to a published German [\*\*6] application, n11/ which discloses a process for the production of hydroquinone from 1,4-diisopropenylbenzene n12/ in the presence of glacial acetic acid as the solvent, either mineral acids or Friedel-Crafts type compounds as the catalyst, and hydrogen peroxide as the oxidizing agent. The pertinent examples indicate yields of hydroquinone of about 10-35%. n13/

n11/ German patent application No. S33,841 (now patent No. 947,308), filed June 12, 1953, by Societe des Usines Chimiques Rhone-Poulenc and published on February 23, 1956.

n12/ 1,4-diisopropenylbenzene has the following structure: [See illustration in original.]

n13/ The second affidavit of appellant ("Carleton II") reports an experiment similar to those of the German application in which 1,4-diisopropenylbenzene was also the starting material. A yield of about 28% of hydroquinone was obtained.

#### The Decision Below

The board found that the cited references "make out a strong case of prima facie obviousness" against appellant's claims, because (1) the starting material of the claimed process is encompassed in Saunders' generic starting materials; (2) the oxidizing agent in the claimed process (hydrogen peroxide) [\*\*7] is stated by Saunders to be the preferred peroxide (due to its low cost); and (3) Saunders and Jones disclose all of the other reaction conditions. It further found that the disclosure of hydroquinone production by the Saunders process, "albeit from a different starting material than the one recited in appellant's claims, would lead one of ordinary skill to expect that the presence of the first formed hydroxyl group [on the benzene ring] would not interfere with the process of forming the second hydroxyl group."

The board said the affidavit evidence was unpersuasive and concluded that the Carleton I and II affidavits failed to follow the prior art closely enough. It particularly criticized the concentration of the reactants and catalysts and the short reaction times.

On reconsideration, the board adhered to its original decision, saying that the affidavits merely indicate that it is possible to operate within the teachings of Saunders without obtaining a good yield. It also said that the Dai II result conflicts with the result in example 9 of appellant's specification, illustrating that there can be considerable variation in yield from "minor modification in reaction conditions." [\*\*8]

#### OPINION

We do not agree with the board's characterization of the showing made by [\*1024] the examiner as a "strong" *prima facie* case. [HN1] In a 35 USC 103 case, the burden of proof is on the PTO to establish a *prima facie* case of obviousness, *In re Warner*, 54 CCPA 1628, 379 F.2d 1011, 154 USPQ 173 (1967), cert. denied, 389 U.S. 1057 (1968), and, once this has been accomplished, the burden of going forward with evidence to rebut that *prima facie* case is shifted to the applicant. *In re Murch*, 59 CCPA 1277, 464 F.2d 1051, 175 USPQ 89 (1972); *In re Hyson*, 59 CCPA 782, 453 F.2d 764, 172 USPQ 399 (1972). [HN2] Whether a *prima facie* case is "strong" or "weak" is not material. If the applicant presents rebuttal evidence, the decisionmaker must consider all of the evidence of record (both that supporting and that rebutting the *prima facie* case) in determining whether the subject matter as a whole would have been obvious. n14/ *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *In re Lewis*, 58 CCPA 1270, 443 F.2d 389, 170 USPQ 84 (CCPA 1971). The correct procedure for considering rebuttal evidence was set forth by this court in *In re Rinehart*, *supra* at 1052, 189 USPQ at 147:

n14/ The Solicitor's brief states that "the [HN3] issue is whether the decision of the Board of Appeals was clearly erroneous." However, "obviousness [HN4] is a legal conclusion based on factual evidence, *Graham v. John Deere Co.*, [383 U.S. 1, 148 USPQ 459 (1966)]... and not a factual determination." *In re Warner*, 54 CCPA 1628, 1634 n.6, 379 F.2d 1011, 1016 n.6, 154 USPQ 173, 177 n.6 (1967). [HN5] Therefore, the proper issue before us is whether the board erred, as a matter of law, in holding that the claims were properly rejected under 35 USC 103. In deciding this issue the court will make "an independent determination as to the legal conclusions and inferences which should be drawn from... [the findings of fact]." See *United States v.*

599 F.2d 1021, \*; 1979 CCPA LEXIS 241, \*\*;  
202 U.S.P.Q. (BNA) 165

*Mississippi Valley Generating Co., 364 U.S. 520, 526 (1961).*

[\*\*9]

Though the burden of going forward to rebut the prima facie case remains with the applicant, the question of whether that burden has been successfully carried requires that the entire path to decision be retraced. An earlier decision should not, as it was here, be considered as set in concrete, and applicant's rebuttal evidence then be evaluated only on its knockdown ability. Analytical fixation on an earlier decision can tend to provide that decision with an undeservedly broadened umbrella effect. [HN6] Prima facie obviousness is a legal conclusion, not a fact. Facts established by rebuttal evidence must be evaluated along with the facts on which the earlier conclusion was reached, not against the conclusion itself. Though the tribunal must begin anew, a final finding of obviousness may of course be reached, but such finding will rest upon evaluation of all facts in evidence, uninfluenced by any earlier conclusion reached by an earlier board upon a different record.

The similarities between the processes of Saunders and those of appellant are evident, the only significant differences alleged by appellant being: (1) the starting material (Saunders uses Alpha-methylstyrene, whereas [\*\*10] appellant uses p-isopropenylphenol), n15/ and (2) the oxidizing agent (Saunders uses t-butylhydroperoxide, whereas appellant uses hydrogen peroxide).

n15/ The structural difference is that appellant's starting material has a hydroxyl group on the benzene ring in the para-position to the isopropenyl group: [See illustration in original.]

Regarding (1), the board noted that the generic description of Saunders' starting materials ("Alpha, Bata-unsaturated alkyl-substituted aryl compounds") encompasses appellant's starting material since the term "aryl" includes the phenyl radical. Assuming that a hydroxyl group on the benzene ring of Saunders' starting material (which is the only difference between the starting material used by appellant and that used by Saunders) would not interfere with the reaction process disclosed by Saunders, the board said that it would have been obvious to make hydroquinone (which differs from phenol only in the hydroxyl group at the para-position) from a starting material such as that used by Saunders, in which a [\*1025] hydroxyl group n16/ is attached at the para-position.

n16/ Or, alternatively, a group, such as an isopropenyl group, which can be readily

converted to a hydroxyl group by Saunders' process. [\*\*11]

Regarding (2), the board noted that, although example 2 of Saunders uses t-butylhydroperoxide as the oxidizing agent, Saunders makes the general observation that hydrogen peroxide is the preferred oxidizing agent "due to its low cost." It concluded, therefore, that it would have been obvious to one skilled in the art to use hydrogen peroxide as the oxidizing agent in appellant's process. In view of the foregoing, we are persuaded that the board properly found that the prior art cited by the examiner established a prima facie case of obviousness. n17/ However, we are also persuaded that the board erred in failing to give proper weight to appellant's rebuttal affidavits, which directly attacked the premises on which the board based its determination of obviousness. Cf. *In re Lewis, supra*.

n17/ As indicated earlier, appellant has not contended that Jones was improperly applied against claims 11-13 and 16.

The only difference between Dai II and example 2 of Saunders is the presence in Dai II's starting material (the same as appellant's starting material) of a hydroxyl group on the benzene ring in the para-position. n18/ The board assumed that this difference would not interfere [\*\*12] with the reaction process disclosed by Saunders. However, the yield of hydroquinone was dramatically less when appellant's starting material was reacted in Dai II according to Saunders' process (47%) than the yield of phenol obtained with Saunders' starting material (80%). Thus, the Dai II result contradicts both the board's assumption and its conclusion that "one of ordinary skill... [would] expect that the presence of... [one] hydroxyl group would not interfere with the process of forming the second hydroxyl group." We are satisfied that one skilled in the art, viewing the Dai affidavit, would have concluded that the presence of such a hydroxyl group results in a significantly lower yield of hydroquinone than the amount that would be obtained with the Saunders' process, and that appellant's starting material could not be readily substituted in Saunders' process to achieve similar results. n19/

n18/ This difference of a hydroxyl group results in hydroquinone being the product in Dai II, rather than phenol, which is produced in Saunders' example 2.

n19/ Contrary to the board's statement that the Dai II result conflicts with the result in example 9 of appellant's specification, the results are consistent. Under different reaction

599 F.2d 1021, \*; 1979 CCPA LEXIS 241, \*\*;  
202 U.S.P.Q. (BNA) 165

conditions (e.g., temperature of 105 degree C in Dai II vs. 30 degree C in example 9), example 9 reports only a 32% yield of hydroquinone. This substantiates the conclusion that a significantly lower yield is achieved when appellant's starting material is used in Saunders' process. [\*\*13]

Appellant also relies upon the published German application n20/ for its teaching that, under the process conditions of the appealed claims, both isopropenyl groups of p-diisopropenylbenzene are not readily converted to hydroxyl groups to yield hydroquinone. n21/ This teaching further supports appellant's position and contradicts the board's assumption that a first formed hydroxyl group would not interfere with the process of forming the second hydroxyl group; moreover, the low yields are in marked contrast to the substantially quantitative yields obtained by appellant.

n20/ Although the teachings of the published German application were argued before the board, it made no mention of the German application in its opinion.

n21/ The low yields of about 10-35% are obtained even though hydrogen peroxide is used as the oxidizing agent. The result of Carleton II (28%) confirms the teaching of the German application.

Finally, appellant has shown by the Dai I affidavit that, despite Saunders' observation that hydrogen peroxide is the preferred oxidizing agent because of its low cost, it would not have been obvious to one of ordinary skill in the art to use hydrogen peroxide [\*\*14] with the starting material of appellant's process. Dai I demonstrates that when hydrogen peroxide is used in Saunders' example 2, a yield of only 15.8% [\*1026] phenol is obtained in contrast to the 80% yield in Saunders' example 2. Accordingly, one skilled in the art would hardly have expected to obtain a substantially quantitative yield if hydrogen peroxide was the oxidizing agent of a different starting material from that used in Saunders' example 2.

The board's response to appellant's rebuttal evidence was:

Appellant's showing that it is possible to operate within the reference disclosure without obtaining a good yield of the desired product is insufficient to refute the teachings of the reference, since they have presented no evidence of making experiments and adaptations which one of ordinary skill in this art would make as a matter of course if he did not immediately obtain the desired results.

Although in appropriate cases such a response might be persuasive, n22/ it overlooks that the two variations from the closest prior art in the tests reported by the affidavits (different starting materials and different oxidizing agents) were the very ones that the board [\*\*15] relied on in finding a *prima facie* case of obviousness. As related above, the results of those tests would negate any expectation of one skilled in the art that these variations in the Saunders' process would result in a substantially quantitative production of hydroquinone. Although there is a vast amount of knowledge about general relationships in the chemical arts, chemistry is still largely empirical, and there is often great difficulty in predicting precisely how a given compound will behave. As the Second Circuit said in *Schering Corp. v. Gilbert*, 153 F.2d 428, 433, 68 USPQ 84, 89 (2d Cir. 1946):

n22/ Cf. *In re Weber*, 56 CCPA 900, 405 F.2d 1403, 160 USPQ 549 (1969); *In re Michalek*, 34 CCPA 1124, 162 F.2d 229, 74 USPQ 107 (1947).

while analogy is at times useful, organic [as well as inorganic] chemistry is essentially an experimental science and results are often uncertain, unpredictable and unexpected.

Accordingly, we hold that the affidavits, when considered with all of the evidence, are sufficient as a matter of law to rebut the *prima facie* case of obviousness.

The rejection of claims 9-13 and 15-16 is reversed.

REVERSED [\*\*16]

**EXHIBIT L**

**IN RE PHILIP S. FAY AND FRED J. FOX**

**No. 7352**

**United States Court of Customs and Patent Appeals**

**52 C.C.P.A. 1483; 347 F.2d 597; 1965 CCPA LEXIS 346; 146 U.S.P.Q. (BNA) 47**

**Oral argument February 5, 1965**

**June 24, 1965**

**PRIOR HISTORY:** [\*\*1]

APPEAL from Patent Office, Serial No. 782,641

appellants' claims were not precluded by prior art and that the affidavit contained information that the board should have considered, and reversed.

**DISPOSITION:**

Reversed.

**OUTCOME:** The court reversed the board because it ignored the purpose for which the affidavit was submitted, viz. as evidence tending to show unobviousness of appellants' invention to one skilled in the art, and its holding was inconsistent for purposes of applying the prior art patents.

**CASE SUMMARY:**

**LexisNexis(R) Headnotes**

**Patent Law > Inequitable Conduct > General Overview  
Patent Law > Nonobviousness > Evidence & Procedure > General Overview**

**Patent Law > Jurisdiction & Review > Subject Matter Jurisdiction > Appeals**

[HN1] The statutory requirements for patentability are novelty, utility and unobviousness. While it is true that proof that an invention is better or does possess advantages may be persuasive of the existence of any one or all of the foregoing three requirements, and hence may be indicative of patentability, Congress has not seen fit to make such proof a pre-requisite to patentability.

**Patent Law > Subject Matter > Products > Compositions of Matter**

**PROCEDURAL POSTURE:** Appellants challenged a decision of the Patent Board of Appeals, which affirmed the patent examiner's rejection of claims in appellants' patent application as not patentable over the prior art.

**OVERVIEW:** Appellants disclosed and claimed leaded gasoline containing a halocarbon compound. In their specification, appellants stated that the halocarbon compounds were effective in modifying the action of the fuel in the engine through the alteration of the amount or nature of the deposits therein so as to reduce the tendency of the gasoline to pre-ignite in an engine. Appellants' arguments were based on the fact that prior art lacked factual data to support the legal conclusion of obviousness under 35 U.S.C.S. § 103; that the use of the claimed additives did not amount to routine trials of obvious variations within the teachings of the prior art; and that the Board of Appeals did not consider the factual data in their expert's affidavit. The court held that

52 C.C.P.A. 1483, \*; 347 F.2d 597;  
1965 CCPA LEXIS 346, \*\*; 146 U.S.P.Q. (BNA) 47

**Patent Law > Jurisdiction & Review > Subject Matter  
Jurisdiction > Appeals**

**Patent Law > Utility Requirement > Chemical Compounds**

[HN2] Such a composition of matter is a new combination. It is necessary, therefore, to consider such a combination as an entity that embodies the invention for which a patent is sought. In other words, it is necessary to consider the invention as a whole, i.e., the mental conception of the invention as well as its embodiment in a particular composition of matter. A patentable invention is a mental result. The product is but its material reflex and embodiment.

**Patent Law > Nonobviousness > Elements & Tests > Prior Art**

**Patent Law > Nonobviousness > Elements & Tests > Claimed Invention as a Whole**

**Patent Law > Nonobviousness > Elements & Tests > Ordinary Skill Standard**

[HN3] 35 U.S.C.S. § 103 requires that the differences between the prior art and the invention for which a patent is sought be ascertained and considered for the purpose of determining whether the claimed subject matter as a whole would have been obvious at the time the invention was made to a person of ordinary skill in the art to which the invention pertains.

**Patent Law > Nonobviousness > Elements & Tests > Prior Art**

**Patent Law > Jurisdiction & Review > Subject Matter  
Jurisdiction > Appeals**

[HN4] The fact that appellants have found a limited class of materials among the necessarily large number of prior art materials is itself a factor to consider as evidence of unobviousness of the claimed invention.

**Patent Law > Nonobviousness > Elements & Tests > Ordinary Skill Standard**

**Patent Law > Claims & Specifications > Enablement Requirement > General Overview**

**Patent Law > Nonobviousness > Evidence & Procedure > Fact & Law Issues**

[HN5] Resolution of the legal issue of patentability under 35 U.S.C.S. § 103 requires the court to consider what would be factually obvious to one of ordinary skill in the art. Factual data in the form of affidavits is of assistance in making this determination. Such affidavits should be given careful consideration.

**COUNSEL:**

Howard L. Weinshenker (Leland L. Chapman, of counsel) for appellants.

Clarence W. Moore (J. E. Armore, of counsel) for the Commissioner of Patents.

**OPINIONBY:**

SMITH

**OPINION:**

[\*1483] Before RICH, Acting Chief Judge, and MARTIN, SMITH, and ALMOND, Jr., Associate Judges, and Judge WILLIAM H. KIRKPATRICK \*

\* United States Senior District Judge for the Eastern District of Pennsylvania, designated to participate in place of Chief Judge Worley, pursuant to provisions of Section 294(d), Title 28, United States Code. [\*1484]

SMITH, Judge, delivered the opinion of the court:

Appellants appeal from a decision of the Board of Appeals, adhered to on reconsideration, affirming the examiner's rejection of claims 1-4 of appellants' application serial No. 782,641, filed December 24, 1958 and entitled "Improved Motor Fuel Composition Containing a Halocarbon Compound" as unpatentable over the prior art.

The prior art consists of the following references:

Lincoln, 2,214,768, Sept. 17, 1940.

Prutton, 2,281,598, May 5, 1942.

Calingaert et al., 2,479,900, Aug. 23, 1949.

Blaker, 2,784,160, Mar. 5, [\*\*2] 1957.

Rudel, 2,838,387, June 10, 1958.

Newman et al., 2,937,932, May 24, 1960.

Appellants have disclosed and claimed leaded gasoline containing a halocarbon compound selected from the group consisting of 1,1-difluoro-2,2-dichloroethane, 1-fluoro-1,2,2-trichloroethane, and 1,1,1-trifluoro-2,3,3-trichloro-2-propene. Claim 1 recites the three compounds in a Markush group, while claims 2 through 4 each recite one of the three compounds individually.

In their specification, appellants state that these halocarbon compounds:

\*\*\* are effective in modifying the action of the fuel in the engine through the alteration of the amount or nature of the deposits therein so as to reduce the tendency of said gasolines to pre-ignite in an engine.

52 C.C.P.A. 1483, \*; 347 F.2d 597;  
1965 CCPA LEXIS 346, \*\*; 146 U.S.P.Q. (BNA) 47

Claim 1 reads as follows:

1. A gasoline for use in internal combustion engines containing appreciable amounts up to 3 cc. of tetraethyl lead per gallon and a fluorine-containing halocarbon compound selected from the group consisting of 1,1-difluoro-2,2-dichloroethane; 1-fluoro-1,2,2, trichloroethane; and 1,1,1-trifluoro-2,3,3,-trichloro-2-propene in an amount at least 0.5 times to 2.0 times the theoretical amount thereof required to convert [\*\*3] the lead to lead fluoride.

It will be seen from the foregoing that appellants are claiming not only a particular class of halocarbons as an additive to gasoline containing tetraethyl lead but also the amount of such additive based on the theoretical amount required to convert the lead to lead fluoride.

Oft repeated rules, like oft repeated myths, seem to die hard. Thus, we find at the outset that the board, despite our contrary holding in *In re Ratti*, 46 CCPA 976, 270 F.2d 810, 123 USPQ 349 said:

There has been no showing of superiority over any of the reference compounds and under the circumstances it may be doubted that any such showing could confer patentability. *In re Krogman*, 42 CCPA 1037; 1955 C.D. 349; 700 O.G. 784; 223 F.(2d) 497; 106 USPQ 276.

[\*1485] [1] As we stated in *Ratti*, [HN1] the statutory requirements for patentability are novelty, utility and unobviousness. We repeat here what we said there: "While it is true that proof that an invention is better or does possess advantages may be persuasive of the existence of any one or all of the foregoing three requirements, and hence may be indicative of patentability, Congress has not seen fit to make such proof [\*\*4] a pre-requisite to patentability." It seems to us, therefore, that to the extent the board's position requires an applicant to make a "showing of superiority over any of the reference compounds" it is clearly in error.

[2] We are dealing here with a composition of matter consisting of a gasoline for use in internal combustion engines to which specific amounts of specified materials have been added. As set forth in appellants' specification:

It has been discovered in accordance with this invention that a motor fuel, and particularly leaded gasoline, can be improved with respect to its tendency toward uncontrolled ignition in an engine by incorporating in the fuel a small amount of at least one fluorine-containing halocarbon compound of the group consisting of 1,1-difluoro-2,2-dichloroethane (F(2)HC-CHCl(2)); 1-fluopro-1,2,2-trichloroethane (FClHC-CHCl); and 1,1,1-trifluoro-2,3,3,-trichloro-2-propene (F(3)C-CCl=CCl(2)). The above compounds are well

known to the art and are commercially available from various sources of supply, and hence it is unnecessary herein to discuss in further detail the preparation of these compounds. \* \* \* Therefore, this invention is based, at least [\*\*5] in part, on the discovery of the specific group of fluorine-containing halocarbon compounds which respond in a gasoline to alleviate pre-ignition of said gasoline in an internal combustion engine.[HN2]

Such a composition of matter is a new combination. It is necessary, therefore, to consider such a combination as an entity which embodies the invention for which a patent is sought. In other words, it is necessary to consider the invention "as a whole," i.e., the mental conception of the invention as well as its embodiment in a particular composition of matter. "A patentable invention is a mental result. \* \* \* The \* \* \* product is but its material reflex and embodiment." *Smith v. Nichols*, 88 U.S. (21 Wall.) 112 (1874).

[3] Due to the fact that chemistry is still largely an empirical science it is easy to characterize inventions in the chemical field as but the result of "routine testing." It cannot be denied that "routine testing" is an essential part of many inventions in the chemical field. But even "routine" testing, whatever that may be, must be guided and directed by the mental concept of the inventor. It seems to us that the board lost sight of these important considerations [\*\*6] when it stated:

With respect to the main point of the argument it is evident that appellants are experimenting with a rather small group of compounds, which it seems the art has clearly directed them to. Each of the last three mentioned patents show [\*1486] chlorobromo-fluoro derivatives of ethane and Blaker may be considered as further directing them to chloro-fluoro ethanes (excluding bromine). With this as a base it can only be concluded that use of appellants' compounds amounts to routine trials of obvious variations within this extremely limited class of halo hydrocarbons. It is well settled that routine experimentation within the teachings of the art is not patentable, even though some improvement may be obtained thereby. *In re Horney*, 34 CCPA 968, 1947 C.D. 302, 603 O.G. 181, 161 F.(2d) 271, 73 USPQ 293; *General Electric v. Watson*, 127 USPQ 326; L. Sonneborn Sons, Inc. v. Coe, 1939 C.D. 54, 502 O.G. 4, 104 F.(2d) 230; *Sherwin-Williams Co., et al. v. Marzall*, 1951 C.D. 48, 647 O.G. 328, 190 F.(2d) 606, 89 USPQ 208; *Mandel Bros., Inc. v. Wallace*, 1948 C.D. 678, 617 O.G. 293, 335 U.S. 291, 79 USPQ 220.

Appellants' arguments for patentability of the appealed claims are [\*\*7] based on three points, (1) that the prior art lacks "factual data" to support the legal conclusion of obviousness under section 103, (2) that the use of the claimed additives does not amount to "routine

52 C.C.P.A. 1483, \*; 347 F.2d 597;  
1965 CCPA LEXIS 346, \*\*; 146 U.S.P.Q. (BNA) 47

trials of obvious variations within the teachings of the prior art," (3) that the "Board of Appeals erred in failing to consider the factual data supplied by the Henne affidavit." We shall consider these arguments in the order stated.[HN3]

Section 103 requires that the differences between the prior art and the invention for which a patent is sought be ascertained and considered for the purpose of determining whether the claimed subject matter as a whole would have been obvious at the time the invention was made to a person of ordinary skill in the art to which the invention pertains. Thus we look first to the prior art to determine what it discloses to the person skilled in the art of gasoline compounding.

Each of the references relied upon in the refusal of the appealed claims discloses the addition of halogenated hydrocarbons to internal combustion engine gasolines. All but Lincoln refer to alkyl lead- or tetraethyl lead-containing gasolines. While Lincoln discloses the use of [\*\*8] halogenated cyclic compounds, Prutton teaches that combinations of halogenated hydrocarbons and oxygen-bearing compounds may be employed for the same purpose, and Rudel shows that the additives may be high molecular weight fluorinated hydrocarbons.

Blaker et al. shows the effective use as additives, for scavenger purposes, of the fluorinated hydrocarbons 1-bromo-1, 1-dichloro-2, 2, 2-trifluoroethane, 1, 2-dibromo-1-chloro-1, 2, 2-trifluoroethane, and 1, 1, 2, 2-tetrachloro-1, 2 difluoroethane. Also, Newman et al. discloses the additive 1, 1-difluoro-2, 2-dichloro-1, 2-dibromoethane, while indicating that many other polyhalogenated hydrocarbon additives were known in the prior art. Calingaert et al. teaches that various bromine substituted hydrocarbons (having 2 to 3 bromine atoms and three to eight carbon atoms) may be employed as the additives, the invention [\*1487] therein also including "the use of these scavengers with chlorohydrocarbons."

Appellants point out in their brief the differences between their invention and the disclosures of the prior art. Thus:

\* \* \* Of the six patents on which the rejection of obviousness is based, four contain express limitations [\*\*9] which exclude Appellants' claimed compounds. Lincoln 2,214,768:

"Among the so-called essence materials, which may be employed for the purpose of accomplishing the above-named desirable ends, are the halogenated ring compounds and more specifically the halogenated aromatic compounds" (R. 42, left column, lines 49-53).

This clearly excludes halogenated ethanes and propenes. Prutton 2,281,598:

"The halogenated oxygen-free organic compounds as noted may be either:

A. Aliphatic such as halogenated:

I. Hydrocarbons,

Notably, those containing from four to ten carbon atoms, e.g.:

Fluorinated hexane

Fluorinated octane

Fluorinated decane"

(R. 48, left column, lines 54-63)

This clearly excludes halogenated ethanes and propenes. Calingaert et al 2,479,900:

"Our invention is the use as scavengers of the class of bromine-substituted hydrocarbons having two to three bromine atoms and from three to eight carbon atoms inclusive, having not more than one bromine atom attached to any carbon atom, and having a vapor pressure at 50 degrees C. of substantially 0.2 to 6 millimeters of mercury." (R. 56, left column, lines 13-19.)

This clearly excludes halogenated ethanes and [\*\*10] bromine-free propenes. Rudel 2,838,387:

"The compounds for use in the present invention must contain at least 14 carbon atoms and preferably at least about 22 carbon atoms." (R. 66, left column, lines 27-29.)

This clearly excludes halogenated ethanes and propenes.

The remaining two patents admittedly are the most pertinent of the lot, but their teachings are so limited that they can easily be summarized in tabular form:

Blaker 2,784,160:

Operative Compounds

(R. 61 left column, lines 55-59)

$\text{BrCl(2)C - CF(3)}$  (halogenated ethane)

$\text{BrClFC - CF(2)Br}$  (halogenated ethane)

$\text{Cl(2)FC - CFCl(2)}$  (halogenated ethane)

Inoperative Compounds

(R. 63 left column, lines 1-10)

$\text{FCl(2)C - CClF(2)}$  (halogenated ethane)

$\text{F(2)BrC - CBrF(2)}$  (halogenated ethane)

$\text{BrH(2)C - CBrF(2)}$  (halogenated ethane)

$\text{CCl(3)F}$  (halogenated methane)

52 C.C.P.A. 1483, \*; 347 F.2d 597;  
1965 CCPA LEXIS 346, \*\*; 146 U.S.P.Q. (BNA) 47

H(2) CBrCl (halogenated methane) [\*1488]  
Newman et al 2,937,932:

Operative Compound

\* \* \*

F(2) BrC - CCl(2) Br (halogenated ethane)

In summary, therefore, it is appellants' position that the six prior art patents disclose no halogenated propenes, four operative halogenated ethanes, three inoperative halogenated ethanes, and two inoperative [\*11] halogenated methanes.

In their request for reconsideration of the board's decision appellants also urge that:

As was pointed out to the Examiner in an amendment dated January 31, 1961, the term "halogenated ethane" (where the halogen is F, Br, Cl or I) embraces more than 600 compounds. The field defined by the Board is somewhat narrower by the exclusion of iodine but vastly broader by the inclusion of "lower aliphatic" which embraces saturated and unsaturated compounds of varying carbon chain lengths, so that without further calculation it should be apparent that the Board's field embraces literally thousands of compounds. It is respectfully submitted that a disclosure of four operative and five inoperative compounds does not define a field embracing thousands of compounds.

If the teachings of Rudel et al are included as representative of "lower aliphatic" compounds embraced by the Board's field definition, then the carbon chain lengths run up to 14 through 22 and higher. This would add thousands upon thousands of additional compounds to the field, none of which contain less than 14 carbon atoms, and are therefore quite remote from the applicants' claimed 2 and 3 carbon [\*12] atom-containing compounds.

[4] It seems to us, therefore, that [HN4] substantial differences exist between the teachings of the prior art and the invention here claimed. The fact that appellants have found a limited class of materials among the necessarily large number of prior art materials is itself a factor to consider as evidence of unobviousness of the claimed invention. See *In re Ruschig*, 52 CCPA 1238, 343 F.2d 965, 145 USPQ 274.

The board's position that appellants' invention is unpatentable is based upon its finding that Blaker, Rudel and Newman et al. "show chloro-bromo-fluoro derivatives of ethane and Blaker may be considered as further directing them [appellants] to chloro-fluoro ethanes (excluding bromine)". It is from this "base" that the board finds that appellants "are experimenting with a rather small group of compounds, which it seems the art has clearly directed them to." Predicated upon this

interpretation of the prior art, the board then states, "It is well settled that routine experimentation within the teachings of the art is not patentable \* \* \*."

[5] We question the board's position because we agree with appellants that the group of compounds to be [\*13] tested is not a "rather small group" and we do not find in the art teachings which may be said to have "directed" appellants to the compounds here claimed. However, [\*1489] even if the board be correct and we be in error on this point, we do not agree that "routine experimentation" negatives patentability. The last sentence of section 103 states that "patentability shall not be negated by the manner in which the invention was made."

To support the board's decision that "routine experimentation within the teachings of the art" will defeat patentability requires a primary determination of whether or not appellants' experimentation comes within the teachings of the art. Whether the subsequent experimentation is termed "routine" or not is of no consequence.

The best one skilled in the art might glean from the prior art is that any conclusion about the operativeness of halogenated ethanes not disclosed therein would be based on pure speculation, and would be the subject of experimental testing. Many of these tests are of necessity "routine" tests, yet they must be so guided and directed as to eliminate the areas of speculation. Our conclusion in *In re Sporck*, 49 CCPA 1039, [\*14] 301 F.2d 686, 133 USPQ 360, seems particularly appropriate:

\* \* \* Here, neither the record nor the facts of which we are able to take judicial notice supplies the factual data necessary to support the legal conclusion of obviousness of the invention at the time it was made. We are unwilling to substitute speculation and hindsight appraisal of the prior art for such factual data. For this reason we think there is a doubt as to the factual basis supporting the conclusion of the board of appeals that the invention would have been obvious to one of ordinary skill in the art of metal spinning. Under these circumstances, the doubt should be resolved in favor of the applicant. *In re Devine*, 46 CCPA 725, 261 F.2d 240, 120 USPQ 84; *In re Altmann and Bureau*, 46 CCPA 818, 264 F.2d 894, 121 USPQ 262.

In the present case, appellants' invention is not concerned with optimizing proportions of prior-art compounds, nor is the prior art so replete with operative examples of halogenated ethanes and propenes that it can be said that a line of investigation of further compounds has been indicated.

We pass now to the asserted error of the board in refusing to consider the factual data supplied [\*15] by

52 C.C.P.A. 1483, \*; 347 F.2d 597;  
1965 CCPA LEXIS 346, \*\*; 146 U.S.P.Q. (BNA) 47

the Henne affidavit. The role of affidavits in resolving the legal issue of obviousness under section 103 is well established. We stated in *In re Lulek*, 49 CCPA 1323, 305 F.2d 864, 134 USPQ 352:

[HN5] Resolution of the legal issue of patentability under 35 U.S.C. 103 requires us to consider what would be factually obvious to one of ordinary skill in the art. Factual data in the form of affidavits is of assistance in making this determination. We think such affidavits should \*\*\* be given careful consideration.

[6] The board stated that the Henne affidavit is essentially an opinion and as such carries little weight. It seems to us that one as well qualified in the highly technical art of fluoride-containing halogenated [\*1490] compounds as Henne is shown to be is properly entitled to express his expert opinion, and that such an opinion is entitled to be given consideration with the other evidence in the case in determining whether the conclusion of obviousness is supported by the opinion of the examiner as to what the prior art teaches. For the reasons previously stated we do not think the prior art teachings furnish factual support for the examiner's opinion.

In [\*\*16] reviewing the board's decision it seems to us that it does not relate the factual data in the affidavit to the issue of unobviousness. Rather the board stated:

\* \* \* Henne's observance of distinctions in the bonding and splitting of the hydrocarbons beginning at the bottom of page 4 and running through page 5 of the affidavit, seems to us to be of little significance when appellants profess ignorance of the precise action of these halohydrocarbons in the gasoline engine.

This holding of the board is erroneous for two reasons. First, it ignores the purpose for which the affidavit was submitted, viz. as evidence tending to show unobviousness of appellants' invention to one skilled in the art. Second, the board's holding is inconsistent with its treatment of the "action" of appellants' holohydrocarbons for purposes of applying the prior art patents. In this latter context, the board stated:

\* \* \* Appellants profess not to know the precise action of their halogenated hydrocarbons, but for convenience they may be regarded as scavenging agents. [Emphasis added.]

The factual data in the Henne affidavit consists of an enumeration of basic chemical differences between

appellants' [\*\*17] claimed compounds and those of the prior art. Thus, in discussing the criticality of the presence of fluorine in a halogenated compound, Dr. Henne stated:

In organic compounds, we are, \* \* \* concerned with \* \* \* the bonding or bondings they [the halogens] can make with carbon.

Fluorine and carbon are both in the same horizontal period of the table and any bonding they make between themselves will be, from both sides, at the same principal quantum number, namely 2.

By contrast, all the other halogens can only be bonded to carbon at differing quantum numbers (3 for chlorine, 4 for bromine, etc.). There is, therefore, a basic difference between carbon-fluorine bonds on the one hand, and carbon-chlorine, carbon-bromine and carbon-iodine bonds on the other hand.

This difference in bonding leads me to the conclusion that the knowledge of what non-fluorinated halocarbon compounds will accomplish in the high temperature environment of a combustion chamber, would not permit me to predict what fluorinated halocarbon compounds would accomplish in the same environment.

The Henne affidavit presents factual data which appears to show that the presence or absence of hydrogen atoms [\*\*18] in the halocarbon compound influences the behavior of the perhalogenated paraffins in [\*1491] the high temperature environment of the combustion chamber of an internal combustion engine.

The board's statement that the prior art clearly directed appellants to their claimed compounds ignores the existence of the chemical differences discussed in the Henne affidavit. Moreover, the skilled artisan recognizing, as Henne did, that these chemical differences are responsible for the formation of thermal decomposition products different from those formed from the prior art halohydrocarbon additives, and recognizing further from the teachings of the Blaker patent the inoperativeness of certain halocarbon compounds more closely related to the operative prior art compounds than to appellants' compounds, would not be "clearly directed" to appellants' claimed compounds.

In view of the foregoing, the decision of the board is reversed.

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